Deloitte.

Openreach Fault Data
Data analysis

Update report covering the period April 2011 to January 2014

17 February 2014

Contents

Introduction

This document forms an addendum to the Deloitte report entitled ‘Openreach Fault Data, Data analysis’ issued in September 2013 (the ‘September report’) which was commissioned by Openreach and subject to a contract between Deloitte LLP and Openreach dated 13 August 2013. As an addendum to the September report this Deliverable is subject to the same terms and conditions as our original contract.

This update report provides an update to the report delivered to Openreach on 4 December 2013 entitled ‘Addendum to Openreach Fault report – 4-Dec’ (the ‘December report’). In addition to fault data previously analysed (covering the periods September 2011 to October 2013), fault data for April 2011 to August 2011, and for November 2013 to January 2014 (first three weeks of January only) has now been analysed, resulting in a data set spanning 34 months.

Notwithstanding that a copy of this report will be provided to Ofcom for publishing, no-one other than Openreach is entitled to rely on our report for any purpose whatsoever and we accept no duty of care or liability to any other party (including, without limitation, any party who is shown or gains access to this report).

Context for data analysis

Scope of data analysis, definitions and data sources

We refer to our earlier report submitted in September 2013 for the broader context of our data analysis and the key definitions used in both this update report and the September report.

This report incorporates further analysis drawn from additional data for the months of April to August 2011 and November 2013 to January 2014 (first three weeks only); over and above the data used in the December report. Using this enlarged fault data set, a number of graphs have been reproduced from the December 2013 addendum report. This update report is based exclusively on two data sets which Openreach shared with Ofcom:

- Fault data – a database called CDTA.FAULTS. This database includes information on faults and contains in particular the following key fields: Asset Category (i.e. type of line); Line Age (‘state of life’, typically IL or EL); Week End Date; CP Group. This database contains 14 million instances of faults in total and consistently spans a period from 8 April 2011 to 17 January 2014, i.e. a period covering 34 months in total, compared to 24 months in the report dated September 2013

- Lines data – a database called CDTA.WSS. This database includes information on the lines on which faults were or were not detected during the period; it contains in particular the following key fields: Asset Category; Week End Date; CP Group; Very Early Life WSS; Early Life WSS; In-Life WSS, the last three fields being used to derive the ‘state of life’ of the line (IL or EL). This database has 125 million records of lines groupings and spans a period from 8 April 2011 to 17 January 2014, i.e. covering almost 3 years

The timeframe used for the analyses included in this document covers the period from 8 April 2011 to 17 January 2014, i.e. a total period of 34 months.

Key changes to the underlying data sets

The main change made for this report compared to the December 2013 Addendum report, is the exclusion of additional Clear Codes from the scope of this analysis. In January 2014, Openreach carried out a comprehensive review of the full set of 490 Clear Codes, with the objective of aligning as much as possible to the definitions used by Ofcom in its own analysis of faults. The outcome of this review was that:

- A further set of chargeable Clear Codes have been excluded from the initial set. Excluded chargeable clear codes now account for 20.9% of faults versus 19.6% earlier, a difference of 1.3%. Additional faults excluded mainly relate to cases of customer access refused, which are chargeable

- A set of additional Clear Codes were excluded to align with Ofcom’s initial analysis, despite these being non-chargeable and hence non recoverable for Openreach; these account for only 0.3% of faults

- Unclassified faults that are not included within the list of 490 Clear Codes, such as “NULL”, “XXX” and “NO_DATA”, are excluded from the analysis. This corresponds to c.10% of faults

Overall, the set of Clear Codes used in Ofcom’s initial analysis and this analysis align apart from the following types of faults which remain included within the scope of faults analysed in this report:

- Clear Code 152 (3.3% of faults) – faults identified as Right When Tested or cancelled by customers but which remain non-chargeable and hence non recoverable for Openreach

- Clear Code 172 (1.4% of faults) – these faults are also non-chargeable faults and hence non recoverable for Openreach, and are mostly associated with duplicate reports and external damage

We also used a different approach to excluding Exchange faults based on Clear Codes rather than MFL as done previously (3.5% of faults verses 2.2% previously: a difference of 1.3%). Further detail on the specific Clear Codes included in the analyses can be found in the Technical Appendix.

As a result of these changes, and in particular of the exclusion of unclassified faults, fault rates have reduced compared to the December 2013 report – average fault rates for:

- MPF have reduced from 2.09 in the December report to 2.02 in this report; a reduction of 3.5%
- WLR/PSTN have reduced from 1.65 in the December report to 1.52 in this report; a reduction of 8.1%
- WLR+SMPF have reduced from 2.35 in the December report to 2.21 in this report; a reduction of 6.2%

These reductions were expected given that a higher number of faults have been removed from this analysis compared to the previous one. They are not impacting the key findings compared to the December 2013 report.

Key findings

Having reviewed fault data for the period April 2011 to January 2014, our key additional findings to those highlighted in our September report are:

- The two most recent full quarters (2Q and 3Q FY14) show higher fault volumes than in any of the earlier quarters of the period analysed. In particular, the additional months of November 2013 to January 2014 show noticeably higher overall fault rates than the 34 month average
- Line demography continues to change at a rapid pace, with an annual rate of change in excess of 9%. In particular, MPF growth remains the largest contributor to changing line demography. The changing mix of lines continues to contribute to increasing overall fault rate
- The large majority of lines continue to be In-life (IL) lines, with Early-life (EL) lines representing only 4% of total lines (16% of faults). As a result the most significant changes to overall fault rates relate to changes in faults occurring on lines in In-life state
- In-life fault rates have increased in the period November 2013 to January 2014 compared to their three year average. IL fault rates remain higher on data (WLR+SMPF and MPF) than on voice only (WLR/PSTN). In a market where broadband penetration is increasing (line demography) this implies an increase in overall fault rates
- In-life fault rates follow a seasonal pattern. Adjusted for seasonality, we find that on average they have increased between April 2011 and January 2014, continuing in the most recent months
- WLR+NGA lines have so far been excluded from the calculation of WLR/PSTN fault rates. Should these be included, then WLR/PSTN in-life fault rates for the period April 2011 to January 2014 would be on average 10% higher, increasing to 17% higher for the period November 2013 to January 2014
- Early life fault rates have been increasing since 1Q13 in particular in the case of MPF which continues to have a significantly higher Early-life fault rate than other types of lines

1 Line mix

1.1 Evolution of lines by type

Line demography continues to change at a rapid pace, with an annual rate of change in excess of 9%

The mix of asset categories in the overall number of lines has evolved rapidly over the last three years. This has been driven mainly by further broadband penetration (reduction in voice lines), changing network requirements of CPs (shift from WLR+SMPF to MPF), and by Openreach's NGA roll-out (Figure 1). The main changes between April 2011 and January 2014 have been:

- WLR/PSTN: a 9% CAGR reduction in number of lines and a reduction in share of lines from 35% to 26%
- WLR+SMPF: a 9% CAGR reduction in shared data lines and a reduction in share of lines from 44% to 34%
- MPF: a corresponding 19% CAGR increase in lines and an increase from 19% to 31% of its share of lines
- Other: a 105% CAGR increase in 'other' types of lines, mainly NGA. In total, 'other' lines reached 9% of lines in Jan-14

November and December 2013, and January 2014 saw a continuation of these same trends, with the number WLR/PSTN and WLR+SMPF lines at the end of the third week of January further failing versus October 2013 respectively by 0.2 and 0.3 million lines, resp. a (10)% and (12)% CAGR; MPF lines further increasing by 0.2 million lines, a 10% CAGR; and other lines increasing by 0.3 million lines, a 76% CAGR.

Figure 1: Number of lines by line type

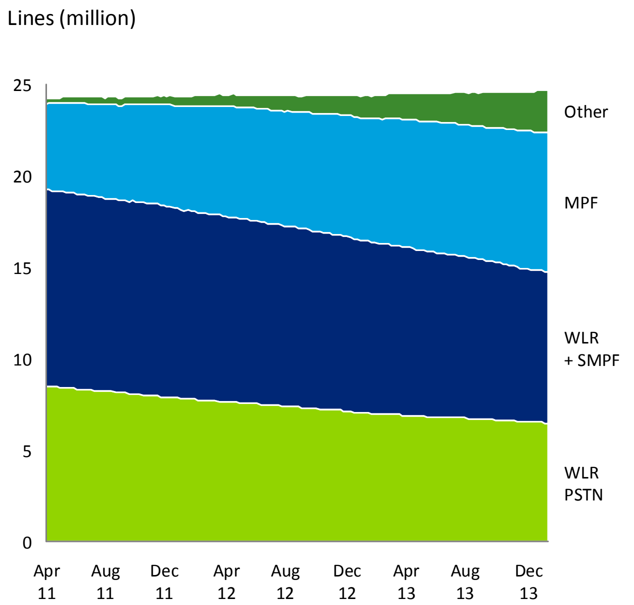


Figure 2: Evolution of lines and fault rates

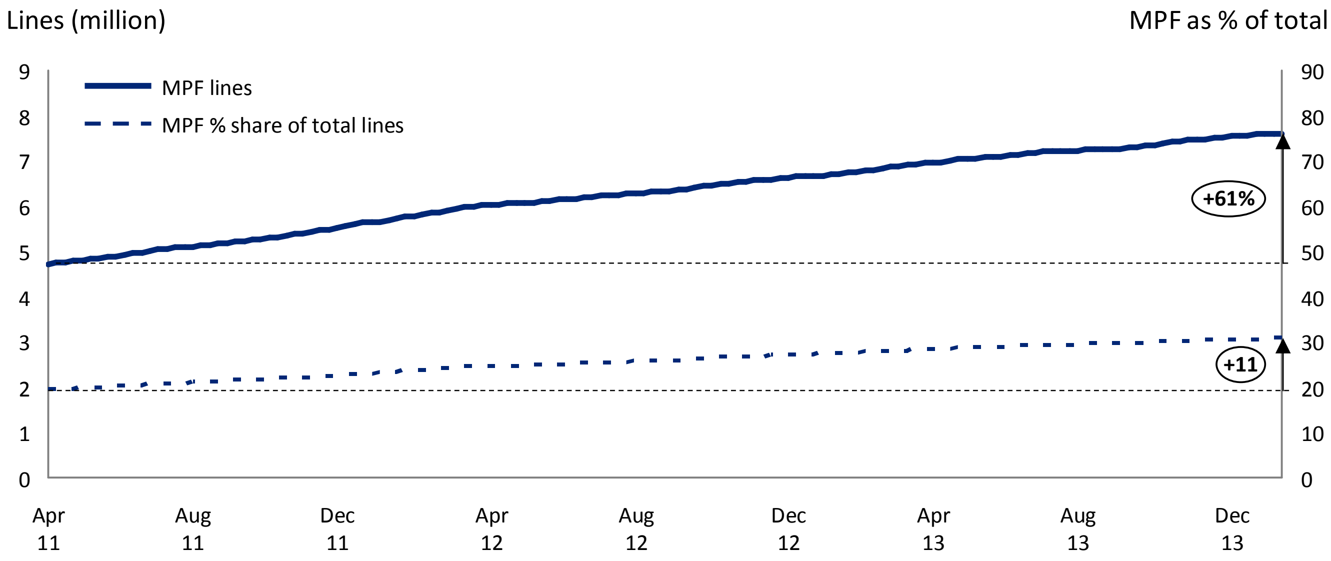
	Lines Apr-11 to Jan-14		Share of lines (%)		Fault rate (faults per week per 1,000 lines)		
	CAGR (%)	Δ (m)	Apr-11	Jan-14	Average	In-life	Early life
Other	105	2.0	1	9	3.3	2.8	7.9
MPF	19	2.9	19	31	2.0	1.7	12.2
WLR + SMPF	(9)	(2.5)	44	34	2.2	1.9	8.0
WLR PSTN	(9)	(2.0)	35	26	1.5	1.4	7.4

The types of lines which are most rapidly increasing (data) are also the ones for which the average overall fault rate is higher. Should fault rates by line type remain stable and line volumes continue to follow the same trends then average overall fault rate would increase.

MPF growth remains the largest contributor to changing line demography

As illustrated in Figure 3, MPF is growing at the fastest rate of all types of lines, an overall growth of over 50 per cent between April 2011 and January 2014. MPF lines now represent approximately 30% of the lines from less than 20% in 2011.

Figure 3: Evolution of MPF lines and share of total



1.2 Evolution of lines by 'state of life'

Lines can also be split between two main types: Early-life (EL), when the last work order on the line was carried in the last 28 days and In-life (IL), when the last work order on the line was carried out more than 28 days ago.

The large majority of lines continue to be In-life (IL) lines

Lines which are in an In-life state represent typically over 95% of the lines. The activity on fixed lines varies by type of line, with on average at any one point in time around 2% of WLR/PSTN lines; 5% of WLR/SMPF lines and 3% of MPF lines are associated with a work order having taken place within the last 28 days (Early-life) (Figure 4).

Figure 4: Early-life lines vs. In-life lines

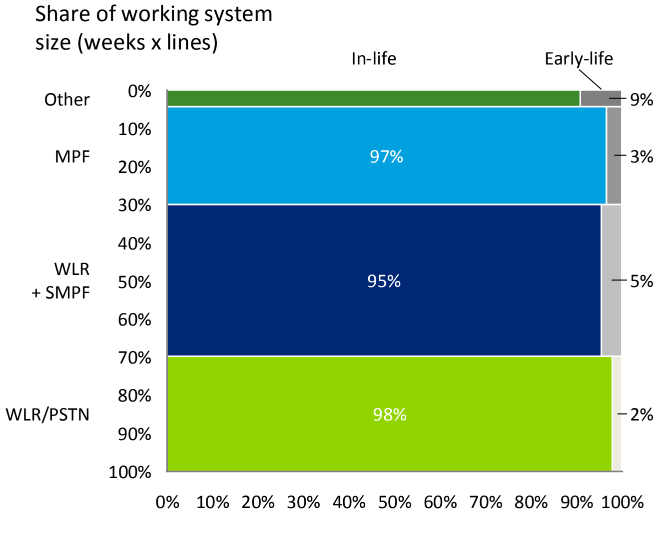
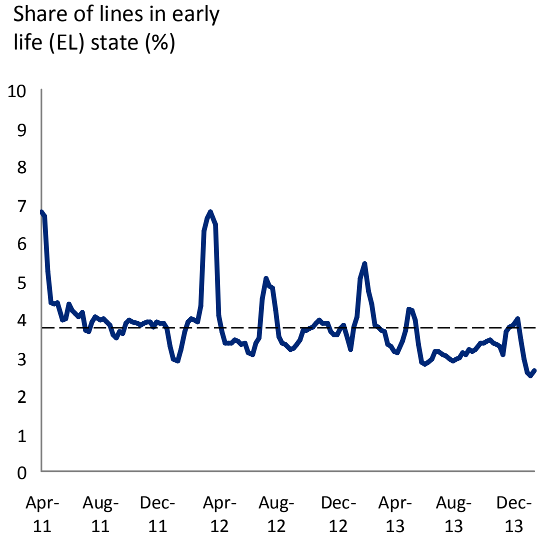


Figure 5: Evolution of the share of Early-life lines



The share of Early-life (EL) lines has marginally trended downwards over the period, with the implied effect of reducing overall average fault rates

On average, the share of EL lines is approximately 4%. The share of lines in an Early-life state (Figure 5) has been trending downwards over the period between April 2011 and January 2014, albeit for short transitory periods in April 2011, July 2012, February 2013, May 2013 and December 2013., A reduction in the number of EL lines leads to a reduction in overall average fault rates (as EL faults rates are higher than IL fault rates).

2 Fault mix

There are approximately 7.1 million faults falling within the scope of our analysis[1] – faults received by Openreach between 8 April 2011 and 17 January 2014. This equates to an average of 48,900 in-scope faults per week over the period. In the months of November and December 2013, and January 2014, weekly faults stepped up to 56,800 in-scope faults per week, or a 16% higher weekly inflow than the full period average.

2.1 Evolution of faults by type of line

Most recent quarters show higher fault volumes than the three year average

The additional fault data available for the last quarter of 2013 confirmed the anticipated step up in weekly faults – 3Q FY14 had higher fault volumes than the average of all earlier quarters. Q2 FY14 also previously had the highest fault volumes than the average of earlier quarters.

Figure 6: Fault breakdown

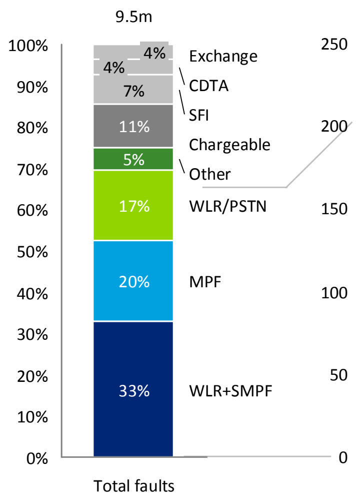


Figure 7: Total faults by line type

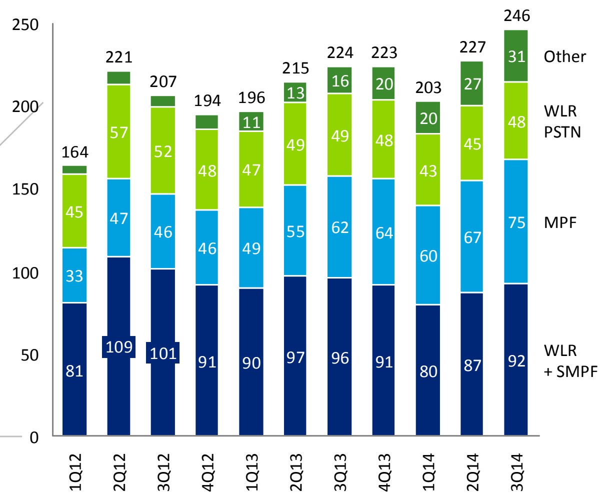


Figure 8: Fault CAGR and share

	2 year CAGR (%)			Share of faults (%)	
	1Q	2Q	3Q	3Q12	3Q14
Other	101	88	100	4	13
WLR PSTN	(1)	(11)	(4)	25	19
MPF	34	20	28	22	30
WLR + SMPF	(1)	(11)	(5)	49	37

The increase in overall fault volumes is broadly in line with the evolution of the mix of lines, suggesting that the primary driving factor for the evolution of faults is the number of lines. Consistent with line volumes, the most important driver of in-scope fault volumes is related to MPF, whilst WLR+SMPF faults are decreasing and the ‘Other’ faults category is increasing rapidly. In the case of MPF, the average rate of increase in fault volumes is higher than the growth rate in terms of lines, indicating an average increase in fault rates.

As a result fault rates in in most recent quarters also increased compared to earlier quarters

Given that the number of lines has not increased significantly during the period November 2013 to January 2014, the step up in the number of faults seen in November 2013 to January 2014 resulted in higher overall fault rates (Figure 9). This trend is consistent across the three types of lines as illustrated in Figure 10. The increase versus the three year average is stronger in the case of MPF (13%) and WLR+SMPF (17%) compared with WLR/PSTN (6%).

[1] Faults are excluded on the basis of Clear Codes. Excluded faults correspond mainly to chargeable faults (e.g. BBB, CDTA, SFI excluding those which are non-chargeable) and faults recorded within the Exchange. A full list of Clear Codes excluded is provided in the Technical Appendix.

Figure 9: Average overall fault rates by line type
(includes both In-life and Early-life)

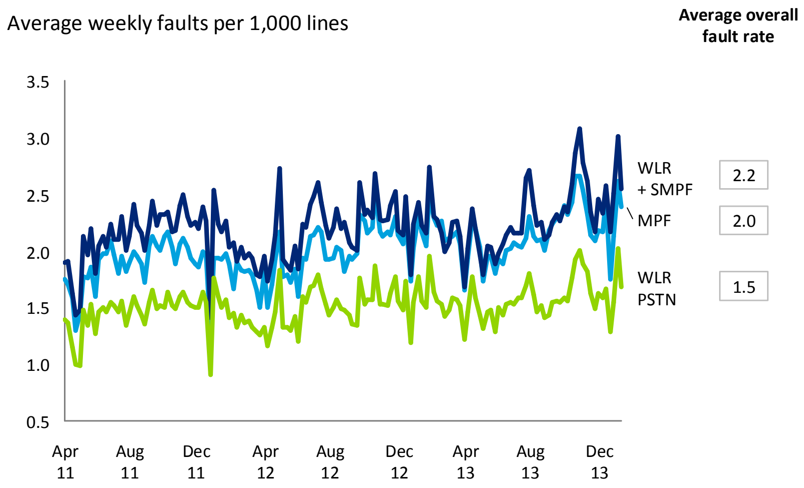
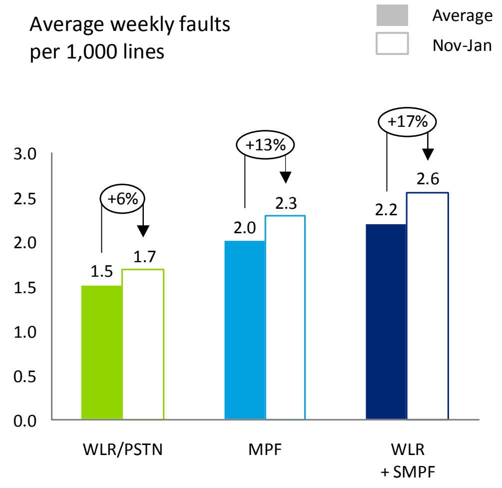


Figure 10: Increase in overall fault rate, Nov 2013-Jan 2014 vs. three year average



2.2 Evolution of faults by ‘state of life’

The share of faults occurring on Early-life (EL) lines remains broadly stable at approximately 16%

Over the period April 2011 to January 2014 on average 16% of faults were on Early-life lines compared to 84% on In-life lines (Figure 12). Between November 2013 and January 2014 the share of Early-life faults to the total number of faults has remained close to its three year average of approximately 16%, hence it does not appear that the increase in faults would have been associated with a higher level of work order activity on the lines. Besides, the share of Early-life faults has marginally reduced over time.

The number of faults occurring on EL lines varies by type of line (Figure 11); it is higher on other lines and on MPF lines than on WLR+SMPF and WLR/PSTN lines. A similar distribution pattern has remained in the period November 2013 to January 2014.

Figure 11: Early-life faults vs. In-life faults

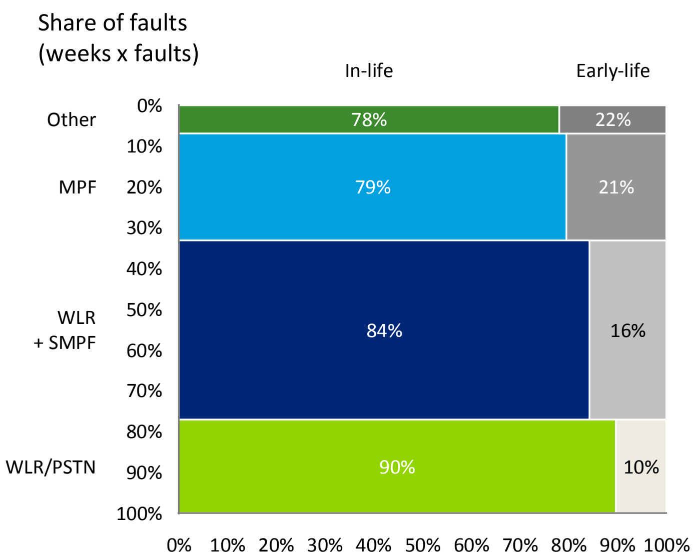
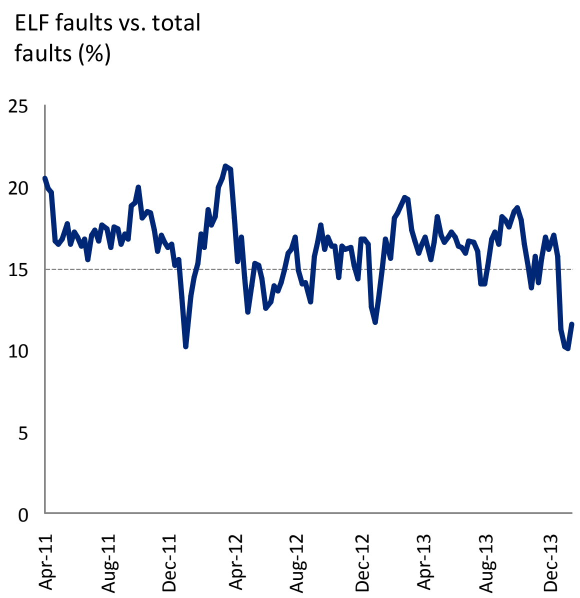


Figure 12: Evolution of the share of Early-life faults

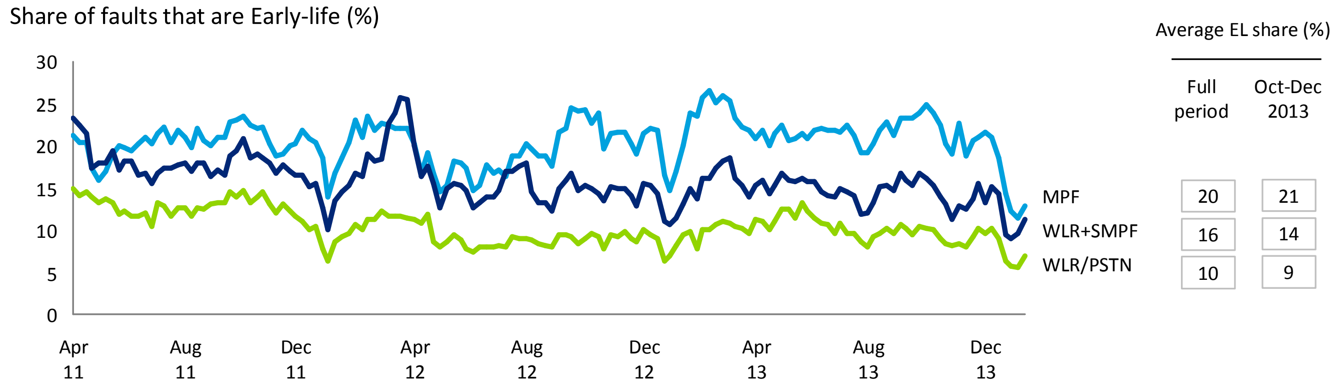


The share of faults occurring on Early-life lines has remained higher on MPF than on other types of lines

Whilst there were more faults between October 2013 and December 2013 than in earlier periods, the share of faults which occurred on Early-life lines was not greater than in earlier periods. This was also the case for MPF and WLR+SMPF despite these type of lines having seen an increase in overall fault rate during Oct-Dec 2013; for these the share of EL faults remained broadly stable at respectively 21% and 14%.

The share of faults occurring on EL lines continued to be higher for MPF than for other types of lines, partly as a result of a higher rate of customer driven interventions on MPF compared to other types of lines.

Figure 13: Share of faults that are Early-life by line type



3 In-life fault (ILF) rates

The main changes to ILF rates in the period November 2013 to January 2014 is an increase in ILF rates for all types of lines and an increase in the difference between ILF rates of data lines versus the ILF rate of WLR/PSTN.

3.1 In-Life fault (ILF) rate by type of line

ILF rates for all types of lines have increased in November 2013-January 2014 versus their 34 month average

In the period November to January 2014 the ILF rate of WLR+SMPF remained the highest compared to the ILF rate of WLR/PSTN and of MPF (Figure 14). In-life rates increased in the period November 2013 to January 2014 when compared to their year average over the 34 months period, by 19% in the case of WLR/PSTN, by 24% in the case of MPF and by 13% in the case of WLR+SMPF (Figure 15).

Figure 14: In-life fault rates by line type

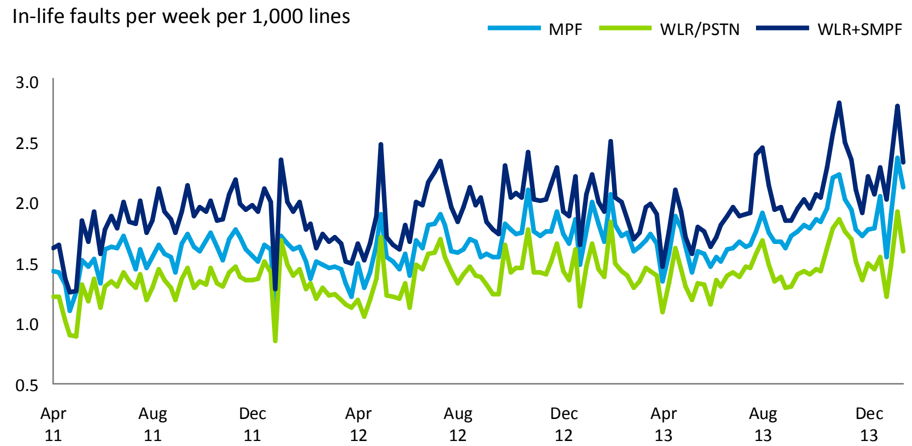


Figure 15: Increase in ILF rates, Nov 13-Jan 14 vs. three year average

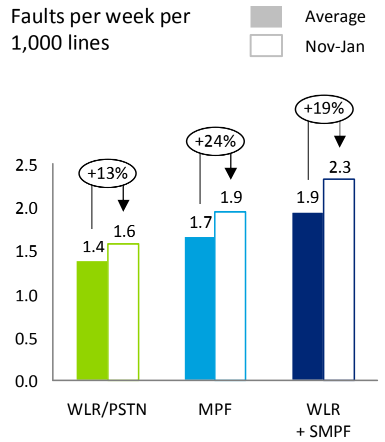


Figure 16: In-life fault rates differential versus voice only lines (WLR/PSTN)

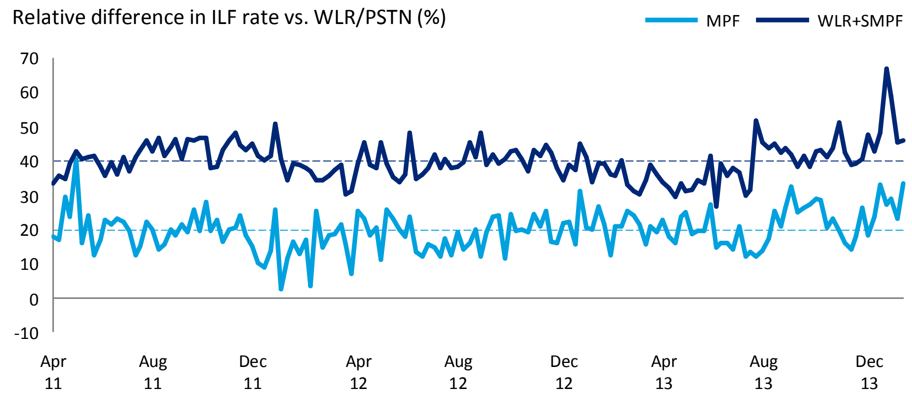
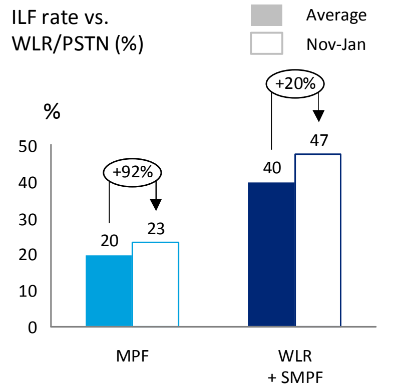


Figure 17: ILF rates differential, Nov 13-Jan 14 vs. three year average



The ILF rates of WLR+SMPF and of MPF remain on average higher than the ILF rate of WLR/PSTN

As illustrated in Figure 16, there remains a clear difference between the ILF rates of data lines (WLR+SMPF, MPF) compared to the ILF rate of voice only lines (WLR/PSTN). The rate differential increased further during November 2013 to January 2014, to 23% in the case of MPF and 47% in the case of WLR+SMPF (Figure 17).

3.2 Seasonality

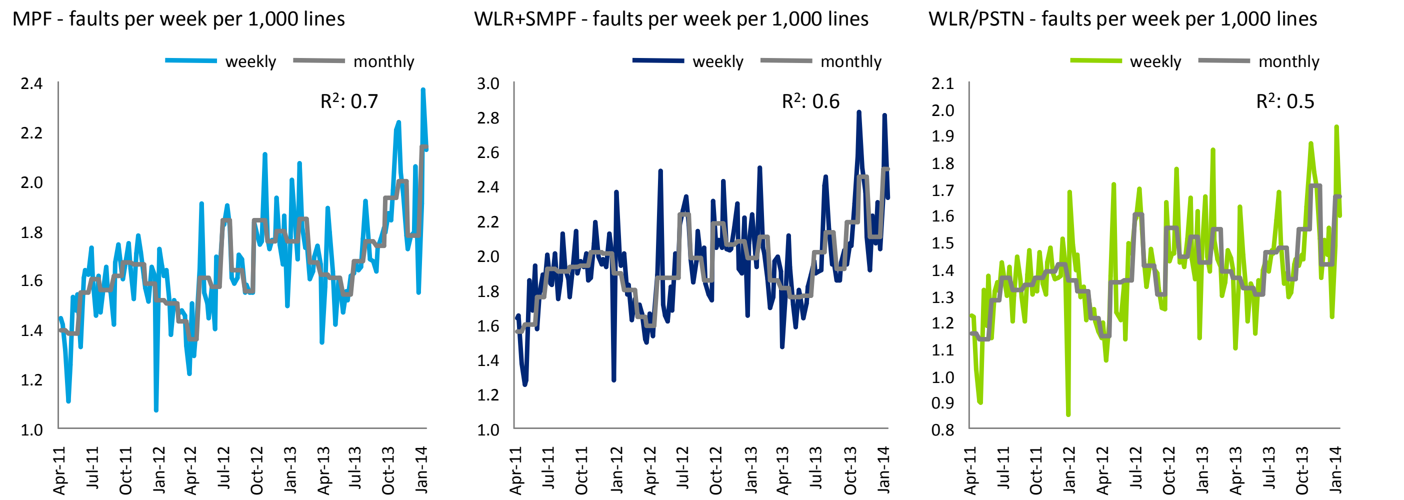
Figure 14 illustrates the short term volatile nature of IL fault rates. Whilst there appears to be clear transitory exceptional periods of higher fault rates (e.g. May 2012, August 2013), average in-life fault rates appear to follow a cyclical evolution, to increase in the winter and mid-season months and then decrease during summer months.

The availability of three years of data allows a year on year comparison of fault rates to derive a seasonality curve, i.e. what average monthly variations have there been compared to a yearly average. This then allows the adjustment of fault rates to those seasonal variations as to investigate underlying patterns of change.

Our overall approach has been as follows:

- Average IL weekly fault rates by calendar month in order to remove short term volatility (Figure 18). The determination coefficient R2 of this monthly model remains satisfactory for the purpose (e.g. MPF: 0.7)
- Compare IL monthly fault rates to the annual average and derive monthly variations to this average ('seasonal variations', expressed in per cent), this for each of year 1, year 2 and year 3. Identify whether those variations are comparable from year 1 to year 3, to validate a seasonality hypothesis (Figure 19)
- Assess whether the average seasonal variations are comparable across line types (Figure 20)
- Remove seasonal variations from actual monthly fault rates ('adjusted fault rates') and compare these rates with the start of the period - second quarter 11/12 - as to assess increasing or declining trends (Figure 21)

Figure 18: In-life fault rates monthly versus weekly fault rates



In-life fault rates follow a seasonal pattern

The availability of three years of data is typically not sufficient to conclude on a repetitive multi-year seasonal trend. However the comparison of IL fault rate variations between year 1, year 2 and year 3 (Figure 19) suggests that there was a repetitive evolution pattern from one year to the other. In the period September to January, fault rates are typically higher, except for the month of December which despite more adverse weather conditions in both year 1 and year 2 is repeatedly a month with lower fault rates. In the period March to June on the contrary fault rates are typically lower than the annual average. This pattern can be observed for year 1, year 2 and year 3 with broadly similar periods and amplitude. There is however in year 2 a seasonal delay of approximately one month vs. year 1, which can also be observed with regard to overall weather conditions in year 2 vs. year 1 (longer winter in year 2).

The comparison by type of line of average fault rate variations to the in-year average (Figure 20) suggests that the seasonal variations are less influenced by the type of line itself than by external factors, as the variations follow a very similar pattern across all line types.

Whilst the average of year 1, year 2 and year 3 variations cannot substitute itself to a multi-year analysis of seasonality factors calculated over a longer period of time, the fact that evolution patterns between year 1, year 2 and year 3 are comparable suggests that these variations can be used as adjustment factors.

Figure 19: Seasonal variations, year 1 vs. year 2

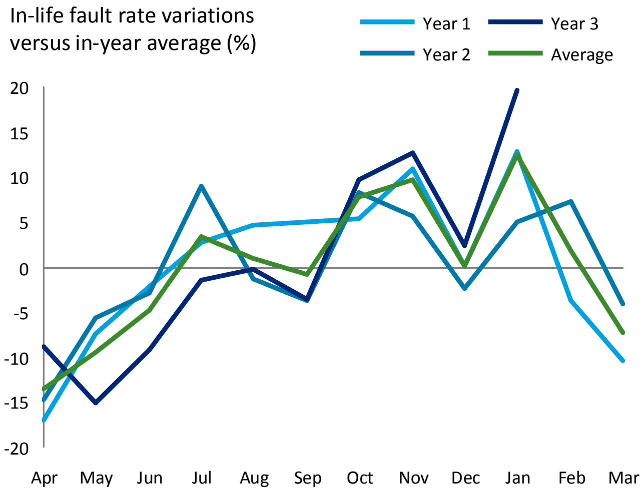
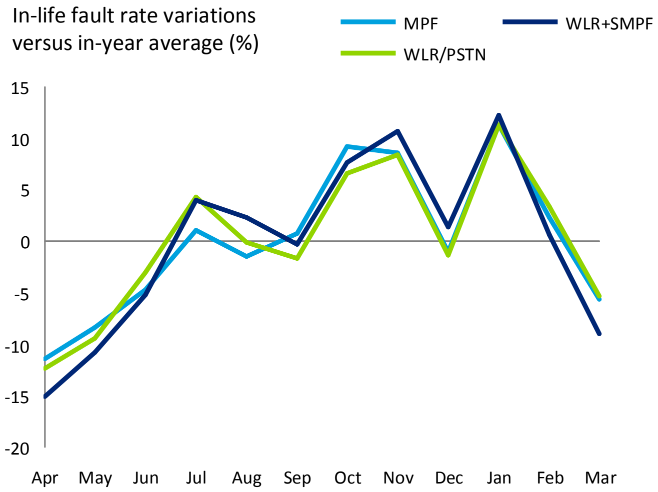


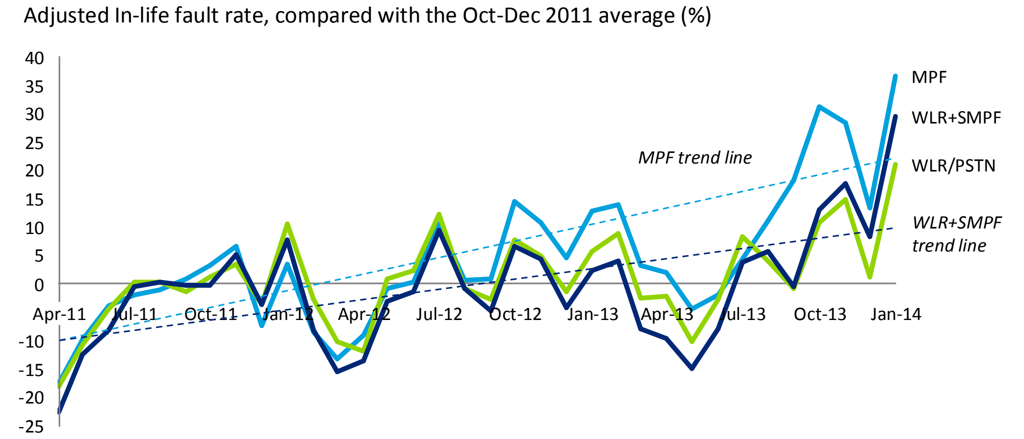
Figure 20: Seasonal variations by type of line



In-life fault rates adjusted for seasonality have increased between April 2011 and January 2014

The adjustment of In-life fault rates for seasonal variations suggests that rates have increased over the period April 2011 to January 2014. Our approach has been to rebase In-life fault rates to the average rates of the third quarter available for the period, i.e. Oct-Dec 2011. We have intentionally not used the first quarter (Apr-Jun 2011) given that this quarter has repeatedly been a low month with regard to IL fault rates (Figure 19) and have used the third rather than the second quarter (Jul-Sep 2011) to investigate the evolution of the Oct-Dec period over two years and ending with the most recent period. The analysis is showing that at the end of the period Oct-Dec 2013 In-life fault rates were 24% higher than two years earlier for MPF, 13% higher for WLR+SMPF and 9% higher for WLR/PSTN, corresponding to compound annual growth rates of respectively 11%, 6% and 4%. We also used a linear regression fit to estimate the average growth rate of the closest interpolating line over the period. The implied growth rates were respectively 11% for MPF, 6% for WLR+SMPF and 5% for WLR/PSTN.

Figure 21: Evolution of adjusted ILF rates versus the average ILF rate July-September 2011



Vs. Oct-Dec 11 (%)		
Oct-Dec 2012	Oct-Dec 2013	CAGR of linear fit
24	24	11
13	13	6
9	9	5

3.3 The impact of including faults on NGA lines

Including WLR+NGA lines into the calculation of WLR In-life fault rates would result in a 10% higher fault rate for the period April 2011 to January 2014, increasing to 17% for November 2013 to January 2014

There are a growing number of WLR+NGA and MPF+NGA lines. Such lines fall within the category called 'Other' (see Section 2, Figure 6). They have been deployed recently and are typically associated with a higher In-life fault rate. As such they have been excluded from fault rate calculations for more traditional WLR/PSTN, MPF and

WLR+SMPF lines in the other sections of this document. However when a fault is reported on a line it is not possible to distinguish whether it is a fault related to the voice service or a fault related to the data service, it is a line fault. Should an overall WLR fault rate were to be calculated, the inclusion of WLR+NGA lines would likely change the fault rate. This section investigates what would be such impact of including WLR+NGA and MPF+NGA lines in the calculation of In-life fault rates.

Figure 22: In-life fault rate on WLR, excluding and including NGA lines

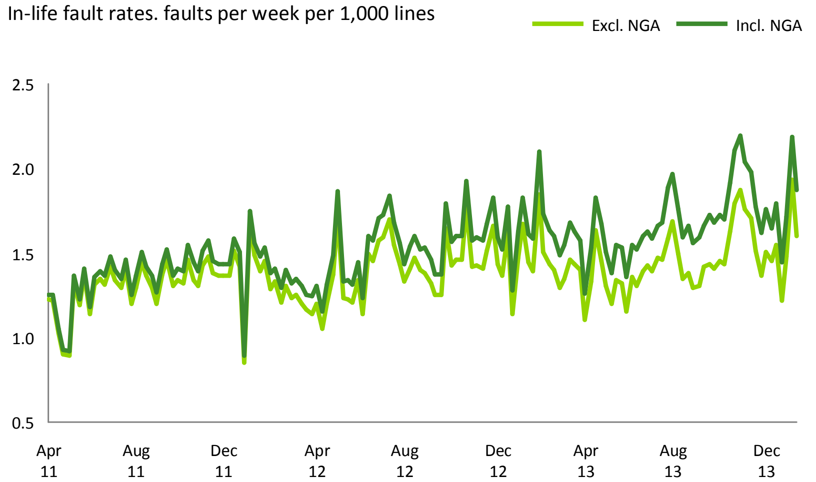
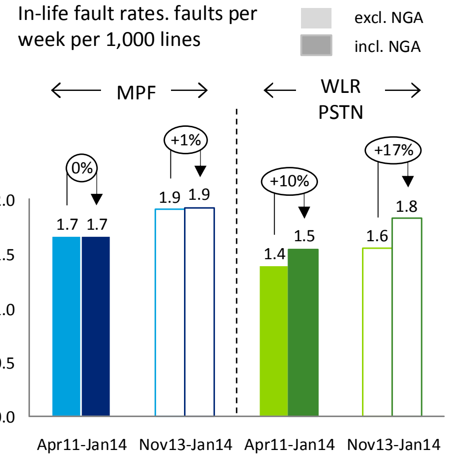


Figure 23: Comparison of NGA impact on WLR/PSTN and MPF



As illustrated in Figure 23, including NGA lines in the calculation of In-life fault rates has a more adverse impact on WLR/PSTN lines than on MPF lines. It increases fault rate by approximately 10% on WLR/PSTN and 0% on MPF on average between April 2011 and January 2014. In the case of WLR/PSTN, the difference between excluding and including WLR+NGA lines in the calculation of WLR/PSTN fault rates also widened over time, partly as a result of the increase in WLR+NGA lines and their increasing weight within overall WLR faults. In the period November 2013 to January 2014 WLR/PSTN In-life fault rate including WLR+NGA lines was approximately 17% higher than excluding them.

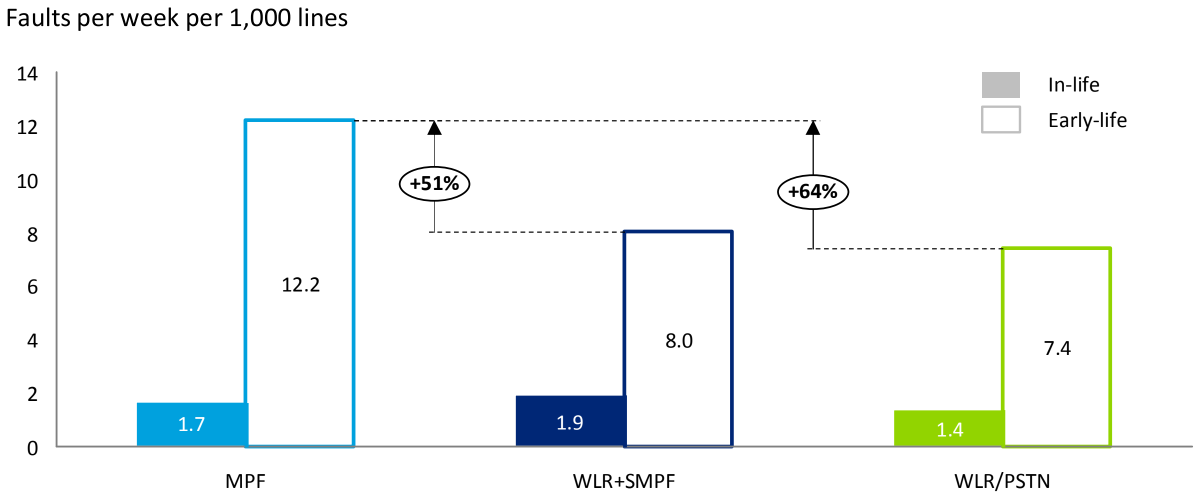
4 Early life fault (ELF) rates

Early life faults cover less than 5% of total lines (Section 1.2) and on average 16% of total faults (Section 2.2).

MPF continues to show a significantly higher Early-life fault rate than other types of lines

The reclassification of lines in the case of Modified Primary Line orders from the December report had a significant impact on ELF rates for lines associated with voice products (WLR/PSTN and WLR+SMPF). Between the data set used in the September report and the data set used in this update report, WLR/PSTN and WLR+SMPF ELF rates have increased from 4.0 and 4.5 to resp. 7.4 and 8.0 faults per week per thousand lines.

Figure 24: Early-life faults vs. In-life fault rates by type of line



Whilst the gap between MPF ELF rates and the ELF rates of other types of lines has narrowed, MPF continues to show a significantly higher ELF rate than other types of lines. As illustrated in Figure 24, MPF ELF rates were still more than 50% above the ELF rates of WLR/PSTN and WLR+SMPF. The contribution of higher ELF rates to the overall fault rate of MPF is compounded by its higher share of EL lines compared to other line types (Section 2.2).

Early life fault rates have been increasing over the period

Excluding transitory periods such as February and May 2013, EL fault rates have been increasing for all types of lines (Figure 25). In particular for the period November 2013 to January 2014, EL fault rates were between 3% higher (MPF) and 12% higher (WLR+SMPF) than their three year average (Figure 26).

Figure 25: Early-life weekly fault rates by line type

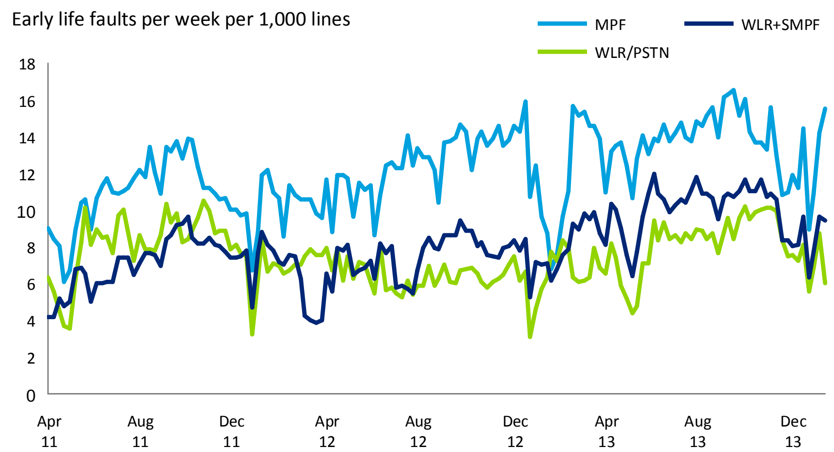
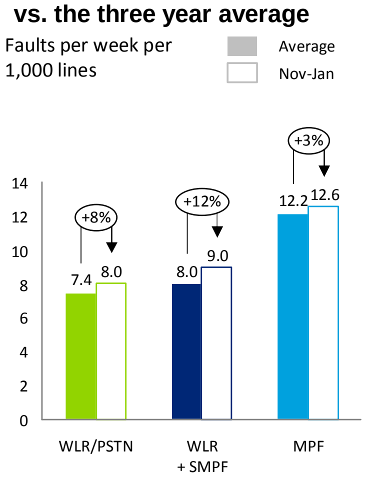


Figure 26: ELF in the period Nov 13-Jan 14 vs. the three year average



Appendix 1: Technical Appendix

Fault types have been excluded from this analysis using Clear Codes as explained in the section Context for Data Analysis. The table below categorises Clear Codes into four categories:

- Exchange faults – excluded from the geographic scope of this analysis
- Chargeable faults – faults defined as chargeable (incl. SFI, BBB and CDTA) and excluded from the analysis as Openreach receives payment for resolving such faults. For the avoidance of doubt, SFI faults, which are non-chargeable are not excluded from the analysis (for instance because the tests have triggered a network resolution considered to be non chargeable on the basis of clear codes)
- Non-chargeable and non-material faults – despite the large number of clear codes, these represent only 0.3% of faults. They have been excluded from the analysis despite being non-chargeable faults
- Other non-chargeable faults – all other faults which are non-chargeable

Included / Excluded	Fault type	Number of Clear Codes in Category	Level 1 Clear Codes Included
Excluded	Exchange	28	1, 2, 3
	Chargeable	58	16, 18, 61, 65, 69, 151, 171, 172.2, 173
	Non-chargeable and non-material	308	10, 11,12,13, 52, 63, 66, 67, 83, 84, 91, 92, 93, 98, 171, 173, 174, 176, 180
Included	Other non-chargeable	96	4, 5, 7, 51, 60, 81, 82, 152, 172
Total		490	

Chart Ref.	Filters	Analytical Methodology
Figure 1: Number of lines by line type **Figure 2: Evolution of lines and fault rates**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only Other (e.g. including NGA) **Dates** Lines: Apr 2011 – Jan 2014 Fault rates: Apr 2011 – Jan 2014	Calculate proportion each Line Type makes up of overall total number of lines by week Identify overall average over the period of analysis, In-Life and Early-Life fault rates for each of the Line Types
Figure 3: MPF share of lines	**Dates** Apr 2011 – Jan 2014	Calculate the total number of MPF lines per week and compare this to the total number of lines per week to calculate the percentage share of all lines
Figure 4: Early-life lines vs. In-life lines **Figure 5: Evolution of the share of Early-life lines**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only Other (e.g. including NGA) **Dates** Apr 2011 – Jan 2014	Calculate the overall split of the number of lines by line type and the number of faults by Line Age (Early-life vs. In-life)

Figure 6: Faults breakdown	**Dates** Apr 2011 – Jan 2014	Calculate the overall split of the faults into categories of interest
Figure 7: Total faults by line type **Figure 8: Fault CAGR and share**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only Other (e.g. including NGA) **Dates** Apr 2011 – Jan 2014	Calculate the overall split of faults by line type over time (using a three month average)
Figure 9: Average overall fault rates by line type **Figure 10: Increase in overall fault rate, Nov 2013-Jan 2014 vs. three year average**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Dates** Apr 2011 – Jan 2014	Divide the number of faults by the working system size by week for each line type; show as faults per week per 1,000 lines Average the fault rate calculated on a weekly basis for the months of November 2013 to January 2014, versus the average of the weekly fault rates calculated over the period September 2011 to November 2013
Figure 11: Early-life faults vs. In-life faults **Figure 12: Evolution of the share of Early-life faults**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only Other (e.g. including NGA) **Dates** Apr 2011 – Jan 2014	Calculate the overall split of the number of lines by line type and the number of faults by age (Early-life vs. In-life)
Figure 13: Share of faults that are Early-life by line type	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Age** Excluding In-Life faults **Dates** Apr 2011 – Jan 2014	Divide faults on Early-life lines by type of line, by the overall number of faults by type of line.
Figure 14: In-life fault rates by line type **Figure 15: Increase in ILF rate, Nov 2013-Jan 2014 vs. three year average**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Age** Excluding Early-Life faults **Dates** Apr 2011 – Jan 2014	Divide the number of In-life faults by the working system size by week for each line type; show as faults per week per 1,000 lines Average the fault rate calculated on a weekly basis for the months of November 2013 to January 2013, versus the average of the weekly fault rates calculated over the period April 2011 to January 2014
Figure 16: In-life fault rates differential versus voice only lines (WLR/PSTN) **Figure 17: ILF**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Age** Excluding Early-Life faults	Calculate the ratio of the number of faults per 1,000 lines to the working system size of lines per week for each line type. Compare on a weekly basis to the WLR/PSTN only fault rate for each line type

rate differential, Nov 2013-Jan 2014 vs. three year average	**Dates** Apr 2011 – Jan 2014	Average the fault rate calculated on a weekly basis for the months of November 2013 to January 2014, versus the average of the weekly fault rates calculated over the period April 2011 to January 2014
Figure 18: In-life fault rates monthly versus weekly	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Age** Excluding Early-Life faults **Dates** Apr 2011 – Jan 2014	Calculate the weekly and monthly average In-life fault rates by line type Calculate the R2 parameter for each weekly versus monthly data series
Figure 19: Seasonal variations, year 1 vs. year 2 **Figure 20: Seasonal variations by type of line**	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Age** Excluding Early-Life faults **Dates** Apr 2011 – Jan 2014	Calculate the average in-life monthly rate for each month of the analysed period, by line type. Calculate the annual average of in-life fault rate by line type Seasonal variations are calculated as the relative difference of monthly fault rates versus the annual average for the year they belong to Year 1 is April 2011 to March 2012. Year 2 is April 2012 to March 2013. Year 3 is April 2013 to January 2014.
Figure 21: Evolution of adjusted ILF rates versus the average ILF rate April-June 2011	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Age** Excluding Early-Life faults **Dates** Apr 2011 – Jan 2014	Adjusted ILF rates are calculated as the actual weekly ILF rates divided by (1+seasonal monthly variation), where seasonal monthly variation has been calculated as defined in Figure 20 Adjusted ILF rates are divided the average ILF rate calculated for the months of April to June 2011
Figure 22: In-life fault rate on WLR, excluding and including NGA lines **Figure 23: Comparison of NGA impact on WLR/PSTN and MPF**	**Line Types** WLR/PSTN Only WLR + NGA **Age** Excluding Early-Life faults **Dates** Apr 2011 – Jan 2014	Calculate the weekly and monthly average In-life fault rates for WLR/PSTN only and WLR/PSTN with or without NGA WLR/PSTN with NGA faults are the sum of faults on WLR only lines, PSTN only lines and WLR+NGA lines
Figure 24: Early-life fault vs. In-life fault rates by type of line	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Dates** Apr 2011 – Jan 2014	Calculate the weekly and monthly average fault rates by line type and Line age

Figure 25: Early-life weekly fault rates by line type	**Line Types** WLR/PSTN Only WLR/PSTN+SMPF MPF Only **Age** Excluding In-Life faults **Dates** Apr 2011 – Jan 2014	Calculate the number of faults per 1,000 lines in the working system size of lines by week for each line type for Early-life lines

Appendix 2: Glossary

Term	Description
NGA	**Next Generation Access**. A BT network technology aimed at replacing the copper pair access to customer premises with fibre technology. This requires modifications of the network infrastructure between the local exchange and the customer premises, albeit depending on each local configuration (FTTC/FTTB/FTTH). In most cases this requires modifications at the street cabinet level
CP	**Communication Provider**. An organisation that provides an Electronic Communications Network or provides an Electronic Communications Service
WLR	**Wholesale Line Rental**. A wholesale product from Openreach for voice service
MPF	**Metallic Path Facility.** A wholesale product from Openreach for both voice and data service
SMPF	**Shared Metallic Path Facility**. A wholesale product from Openreach for data service
WLR+SMPF	Combination of two wholesale products (WLR and SMPF) on a same line, purchased together alongside one another
ELF	**Early-life Fault**. Fault, which has happened within less than 28 days from a new service provision (0 to 27 days)
ILF	**In-Life Fault**. Fault, which has occurred more than 28 days after a new service provision (28 days to 90 days and 90 days and above)
MFL	**Main Fault Location**. Initial diagnostic for the reason and location of the reported fault
CC	**Clear Code.** Final diagnostic for the reason why the fault occurred
Chargeable	**Chargeable Faults**. Includes CDTA, SFI, BBB
CDTA	**Conscious Decision To Appoint**
SFI	**Special Fault Investigations.** Standard Line test has been returned as ok but the CP wants to carry out a more detailed line test
BBB	**Broadband Boost**. A service product whereby a chargeable engineering visit can be ordered when a broadband line tests OK but the end user remains not satisfied with the service.

CL	**Care Level.** Openreach products are associated with different levels of service. CL1 is associated with a response time of 2 days to clear the fault. CL2 is associated with a response time of 1 day. The MPF product is associated with a CL2 response time
PCP	**Primary Connection Point**. Street cabinet
LE	**Local Exchange**. Local building where interconnection for BT lines is done. There are approximately 5,000 local exchanges
MDF	**Main Distribution Frame**. Main point of line interconnection within the Local Exchange

Appendix 3: Disclaimers

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(b) The report was prepared from information and explanations provided to us by the management of Openreach;

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