Executive Summary

From June 27th through June 30th, 2001, CDR7 ("CroSS7") records were collected and compared to call records obtained from an NSTS system of Telcordia during the same time period. 403,763 records were gathered and compared between the two systems.

Of the 403,763 records in the CDR7 validation project, 396,521 (98.21%) matched exactly. There were 7,242 records that did not have matching originating and/or terminating numbers (1.79%) between the two data sets. The breakdown is as follows:

- 4582 records did not match terminating number fields (63.27% of mismatched records)
- 2649 records did not match originating number fields (36.58% of mismatched records)
- 10 records did not match originating or terminating number fields (0.13% of mismatched records)

These records were analyzed further, using three (3) main sources:

1. Documentation of business rulesets for the two call recording systems (CDR7 and NSTS)
2. Protocol Analysis of data stored from DataStore. NOTE: DataStore was removed from Qwest just after the study. The data was captured to tape and ran through Agilent's lab. Not all the data was loadable, so not all calls were able to be validated at the present time.
3. Analysis of the CDR7 records and Telcordia records

Both Agilent and Qwest IT participated in this analysis of the discrepancies. The records in discrepancy were divided into 13 categories of discrepancy types (see distribution below).

After this further analysis, it was determined that 91.67% of the discrepancies were 'resolved'. Resolution means that through this further analysis, a sample of the data from each category was investigated and the results proved that CDR7 did correctly identify the originating and terminating numbers, in accordance with the rulesets of CDR7. This leaves 8.33% of the discrepancies as 'unresolved'.

The 603 remaining unresolved call records represent 0.15% of the overall 403,763 calls. This amount is minimal and falls well under the 1% acceptable error rate. Vibrant Solution stated the following in their final documentation for this study[1]:

> "The Telecommunications industry in general, and Vibrant Solutions in particular, regularly perform comparisons of Call Detail Records as a standard business practice. As a result of that experience, the industry will accept, as normal, a difference of 2 to 3 percent for usage generated by two diverse systems. This is explained by known differences in time increments and measurement intervals that are employed by the various network elements.
>
> In determining the Acceptable Error Rate for this study, the relative similarity between the Agilent CDR7 system and the Telcordia NSTS system must also be considered. That is, both systems measure time to the same degree of accuracy and both systems were configured to begin and end the trial at the same time. Therefore, unexplained discrepancies of more than 1% are seen as likely representations of a real problem and must be considered unacceptable."

In order to resolve the remaining calls, another attempt at loading the post-captured DataStore data would be needed. This is a significant process for both Agilent and Qwest IT due to changes in the configuration of the lab and other factors. Based on the premise provided by Vibrant Solutions, Agilent and Qwest IT are recommending that the study results be accepted as-is. While it may well be possible to resolve the remaining 603 calls, we do not believe that the effort required at this point to analyze these remaining records is warranted. Both Agilent and Qwest IT believe that the purpose of the study has been served – to prove that the installed CDR7 system correctly generates billing records. Of course, the decision on this point is left to the Wholesale Markets customer.

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[1] CDR Validation Project Final Report. Vibrant Solutions. October 26, 2001. Page 3

Below is the explanation of the analysis work completed for the 13 categories of mismatched records. The marking of "RESOLVED" or "UNRESOLVED" is associated with each category.

Terminating Number

4582 Records with differences between CroSS7 and Telcordia data feeds.

1. 3244 records [category 1]: **RESOLVED**
   PRESUMPTION: Telcordia confirmed that they auto-populated "303" area code. Telcordia has also confirmed that their process dropped the last digit (10th digit), shifted digits 7-9 one place to the right, and populated the 7th digit with '-' in error.
   ANALYSIS: Validated one record and found that the Called Party Number was 7 digits. CroSS7's terminating number was these 7 digits with the addition of a default NPA from the point code table. Telcordia used a default of 303 but also lost the 7th digit and replaced with '-'.
   EXAMPLE: Called Party Number field = 777-3456. CroSS7 term number = 303-777-3456. Telcordia term number = 303-777—456.
   RECORD VOLUME: 0.80 % OF TOTAL RECORDS ANALYZED

2. 1218 records [category 2]: **RESOLVED**
   PRESUMPTION: All records indicate call forwarding (Service Feature code of 12 or 14). I called a handful of the CDR term numbers and the Telcordia term numbers and reached the same place of business.
   ANALYSIS: Validated two records. CroSS7 selected the Called Number Field to populated terminating number on the BAF record. Telcordia selected the Original Called Number (OCN) field to populate the terminating number on their CDR record.
   RECORD VOLUME: 0.30% OF TOTAL RECORDS ANALYZED

3. 72 records [category 3]: **RESOLVED**
   PRESUMPTION: Called number was three digits. Telcordia populates the NPA with these three digits and sets NXX-XXXX as 000-0000. CDR7 overwrites with all zeros and then uses the default NPA or NPANXX per the point code table (which contains user defined default values to use depending on trunkgroup number...sometimes the point code table has 000-000 as the default).
   ANALYSIS: Validated two records and found that the Called Number Field in the IAM SS7 message was only three digits in length. CroSS7 replaces any number of 3 digits with the NPANXX from the Point Code Table (default NPANXX set by the CroSS7 technicians in Littleton-Mineral site). Telcordia, on the other hand, just zero fills to the right, maintaining the three signaled digits as the NPA.
   EXAMPLE: Called Party Number = 303 and Point Code table defaultNPANXX=303-093. CroSS7 term number = 303-093-0000. Telcordia term number = 303-000-0000.
   RECORD VOLUME: 0.018% OF TOTAL RECORDS ANALYZED

4. 35 records [category 4]: **RESOLVED**
   PRESUMPTION: There are some similarities in the numbers, but nothing can be concluded.
   ANALYSIS: Validated two records and found that the called number field in the SS7 IAM was 6 digits in length. CroSS7 keeps the last 4 digits as the terminating line number and uses the default NPANXX from the Point Code Table. Telcordia maintains the 6 signaled digits as the NPANXX and zero-fills to the right.
   EXAMPLE: Called Party Number = 303605 and default NPANXX on Point Code Table = 303-093. CroSS7 term number=303-093-3605. Telcordia term number= 303-605-0000.
   RECORD VOLUME: 0.009% OF TOTAL RECORDS ANALYZED

5. 12 records [category 5]: **RESOLVED**
   PRESUMPTION: Telcordia has toll free number while CDR7 has non-toll number.

ANALYSIS: Validated one record and found that CroSS7 pulled the terminating number from the Called Number Field while Telcordia used the Generic Address Parameter field (GAP).
EXAMPLE: Called Party Number field = 3032430290 and GAP field = 8004079251.
RECORD VOLUME: 0.003% OF TOTAL RECORDS ANALYZED

6. 1 record [category 6]: **RESOLVED**
PRESUMPTION: The called number is a numbered service code (311). Telcordia populates these digits in the NPA field, and sets NXX-XXXX as 000-0000. CDR7 rulesets indicate that it will set study indicator=50, overseas indicator=1.it will populate the 3 digits in the NXX and use the default NPA. So, in this one case: Telcordia = 311-000-0000, CDR=303-311-0000.
RECORD VOLUME: 0.0002% OF TOTAL RECORDS ANALYZED

7. 1 record [category 7]: **RESOLVED**
Telcordia = 3038240000
CDR7 = 3038240003
PRESUMPTION: The error is unknown, but the difference doesn't impact switch identification or jurisdiction.
ANALYSIS: Validated this record and found that CDR7 correctly matched the Called Party Number Field.
RECORD VOLUME: 0.0002% OF TOTAL RECORDS ANALYZED

Originating Number

2649 Records with differences between CroSS7 and Telcordia data feeds.

1. 537 records [category 7]: **UNRESOLVED**
PRESUMPTION: Unknown. CroSS7 shows no originating number while Telcordia shows 10digit number.
ANALYSIS: Validated one record and found a record that matched the CroSS7 BAF record. Further analysis of DataStore would be needed to resolve remaining discrepancies. All by 3 records have terminating numbers to cellphones: seems highly suspect of a call forwarding type scenario
EXAMPLE: Record one: Calling Party Number field = 303-882-4479 and Called Party Number field = 303-463-8796. Record two: No Calling Party Number and called party Number = 970-768-9005. Telcordia record: orig number = 303-882-4479 and term number = 970-768-9005. CroSS7 record: no orig number and term number = 970-768-9005.
RECORD VOLUME: 0.13 % OF TOTAL RECORDS ANALYZED

2. 1937 records [category 8]: **RESOLVED (through documentation)**
PRESUMPTION: Unknown. CroSS7 shows no originating number while Telcordia shows 1-3 digits of an originating number, zero-filled to the right.
ANALYSIS: CDR7 rulesets indicate that if a telephone number is 3 digits in length, it is over-ridden with zeros. Telcordia populates the three digits as the area code, followed by 7 zeros.
EXAMPLE: Telcordia record has originating number = 303-000-0000 while CroSS7 has originating number = 000-000-0000.
RECORD VOLUME: 0.48% OF TOTAL RECORDS ANALYZED

3. 43 records [category 9]: **RESOLVED**
PRESUMPTION: Telcordia is not capturing the digits correctly: either due to unexpected number of digits and/or error in system.
ANALYSIS: Validated one record and found an international number. CroSS7 took the last 10digits for orig number field (drop excessive numbers from the left) while Telcordia seemed to take random digits, starting from left but dropping digits from the middle of the field.

EXAMPLE: Calling Party Number field = 44-208-709-2000. CroSS7 orig number = 208-709-2000. Telcordia orig number = 442-870-2000.
RECORD VOLUME: 0.011% OF TOTAL RECORDS ANALYZED

4. 76 records [category 10]: **RESOLVED**
PRESUMPTION: Unknown. CroSS7 shows a 10digit number. Telcordia also shows a 10digit number, but invalid looking.
ANALYSIS: Validated one record and found CroSS7 to match the last 10digits of the calling party number field of the SS7 IAM message. No conclusion made on how Telcordia derived their originating number.
EXAMPLE: calling party number field = 46730586157. CroSS7 = 673-058-6157. Telcordia = 0040030008
RECORD VOLUME: 0.019% OF TOTAL RECORDS ANALYZED

5. 48 records [category 11]: **UNRESOLVED**
PRESUMPTION: Unknown. CroSS7 and Telcordia both have 10 digit originating numbers but they vary greatly.
ANALYSIS: Looking at the raw CDR7 and Telcordia records, Telcordia indicates ANI and CPN were both sent while CDR7 indicates that only CPN was present. DATASTORE data is needed to be analyzed to further investigate.
RECORD VOLUME: 0.01% OF TOTAL RECORDS ANALYZED

6. 8 records [category 12]: **UNRESOLVED**
PRESUMPTION: Unknown
ANALYSIS: Telcordia has less than 6 digit originating numbers while CDR7 has either 10digits or 000-000-0000.
RECORD VOLUME: 0.002% OF TOTAL RECORDS ANALYZED

Originating & Terminating Number

10 Records with differences between CroSS7 and Telcordia data feeds for BOTH originating and terminating number fields.

1. 9 records [category 13]: **UNRESOLVED (terminating number resolved)**
PRESUMPTION: CroSS7 has no orig number while Telcordia has full 10digit numbers. Both records have a full 10 digit terminating number and service feature code showing call forwarding has occurred. All Telcordia terminating numbers are wireless (970-768) numbers.
ANALYSIS: Verified that the records were marked as call forwarded. The terminating number discrepancy is similar to category 2 above.
RECORD VOLUME: 0.002% OF TOTAL RECORDS ANALYZED

2. 1 record [category 14]: **UNRESOLVED**
PRESUMPTION: CroSS7 record has ten digit numbers (orig and term) while Telcordia record has 3 digit orig number and full 10 digit term number.
ANALYSIS:
RECORD VOLUME: 0.0002% OF TOTAL RECORDS ANALYZED