

# Least Cost Routing Analysis

Brandon Zupancic

Canby Telcom

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# Background

- Canby Telcom has both a legacy switch (Siemens EWSD) and a soft switch (MetaSwitch), both running standard Telcordia GR-303 for BLC access in the local loop
- Canby Telcom does not offer VoIP services or SIP / MGCP trunks to end user customers
- VoIP compression is universally known throughout the industry to cause widespread fax transmission failures. The G.729 compression codec is particularly detrimental to fax transmission, but even the G.711 “uncompressed” codec is detrimental to fax transmission.
- VoIP compression codecs are often set by default to G.729 by VoIP IADs and ATAs
- Many Least Cost Routing providers also use the G.729 codec to compress call bandwidth (by a factor of 8) in order to achieve higher call volume throughput
- The Canby MetaSwitch is ITU T.38 compliant for fax transmissions, but both endpoints must be T.38 compliant for this to matter, and LCR may undermine T.38 because the LCR provider does not properly identify a fax transmission differently from a voice call, and T.38 is “lost” and/or compression codecs are likely to be applied by the LCR provider.

# Least Cost Routing

## What is it?

- Routing calls based on criteria to obtain the lowest cost in real time
- Enable routing based on Time of Day, percent utilization, or Quality of Service tiers

## Intended to

- Reduce transport cost
- Streamline routing updates
- Standardize routing platforms
- Ensure greater survivability

Least Cost Routing, *if implemented properly*, would benefit everyone. However, there are currently many unintended consequences of LCR!

Grew rapidly in late 2009 and early 2010. Increased sharply nationwide in 2H'10. Very difficult to troubleshoot because there is often no SS7 record or Call Detail Record generated

# Symptoms of LCR

## Voice Calls –

- Calling party hears ringing, called party hears no ringing
- Called party's phone rings but hears dead air when they answer
- Unusually long call setup times, (= caller hangs up)
- Calling party hears continued ringing, voice mail does not pick up, called party does not get ringing
- Extremely poor quality on answerable calls (severe echo, severely garbled, only one way conversation is audible)
- Many cases – there is no call detail record (CDR) or billing record produced and in some cases, no SS7 record
- “Machine gun effect”: call setup repeatedly fails / re-attempts in rapid succession, so switch call records may show multiple call attempts from the same TN to a single TN in rapid succession (faster than someone could redial). Recipient's phone may never ring or may ring only once or ring intermittently.

Occurs nationwide, but most frequently in LD calls to rural areas

Includes calls originated by LECs, wireless, fixed VoIP (Vonage type), and nomadic VoIP (Google voice type)

# Symptoms of LCR

## Fax Calls –

- Sender's fax machine is unable to successfully establish a "handshake" with the recipient's fax machine
- The fax transmission experiences so much packet delay or retransmission of packets the fax machine terminates the session due to poor line quality
- Most prevalent on Interstate calls, but also happens on Intrastate calls. Non-existent intraswitch, local to local, or legitimate EAS calls since there is no LCR provider involved

Caused by compression codecs. G.729 has the most severe effect, but even the G.711 "uncompressed" codec can adversely affect fax transmissions

# Scope of the LCR Problem

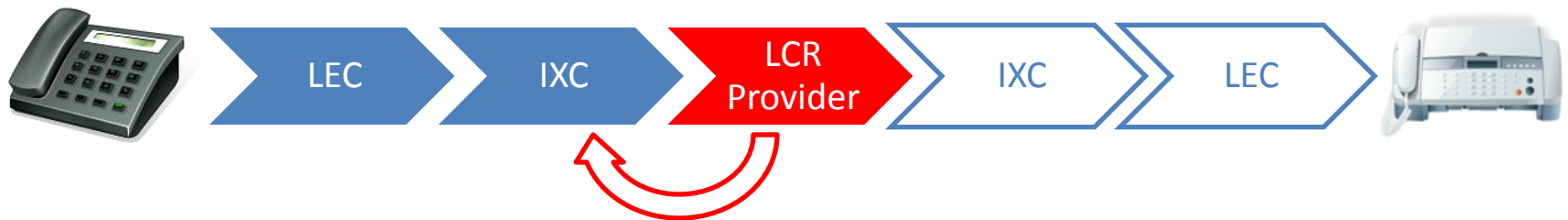
February 2011 NECA Member Survey

- 176 companies in 35 states (85% of respondents) have experienced problems terminating calls due to LCR
- Most complaints started in 2010, esp. in 2H'10.
- Often cyclical / intermittent
- Some telcos receiving more than 20 customer complaints in a single day

*LCR is not an isolated problem, and it is a rapidly growing one*

# LCR Causes of the Problems / Symptoms

- “Routing Loop” – calls can be sent “backward” to a previous carrier / network
  - LCR provider has improper routing tables
  - Some calls never successfully set up because they lack end-to-end network intelligence from the SS7 network



Routing tables may direct the call path back to the IXC it came from because it is the lowest cost route or due to errors in the routing tables. Call routes in a circle until it times out or terminates due to too many “hops”

# LCR Causes of the Problems / Symptoms

- Congestion or low quality IP routes that are designed for data, not voice (high latency, high jitter, high packet loss)
  - Some LCR providers use lowest cost private IP networks
  - in some cases, they use the public Internet
- Improper Call Setup – LCR provider not having the CLLI codes of all terminating end offices in their routing tables
- Some originating carriers route calls to LCR providers whose contracts stipulate that they will not complete calls to certain NPA-NXXs (due to costs to terminate in those areas) – but the originating carrier may not know that and keeps sending calls to that LCR provider destined for that terminating location
- Some nomadic VoIP providers have simply refused to terminate calls to certain areas.

# Financial Impact of LCR (Terminating Access)

## July (August 1 bill date)

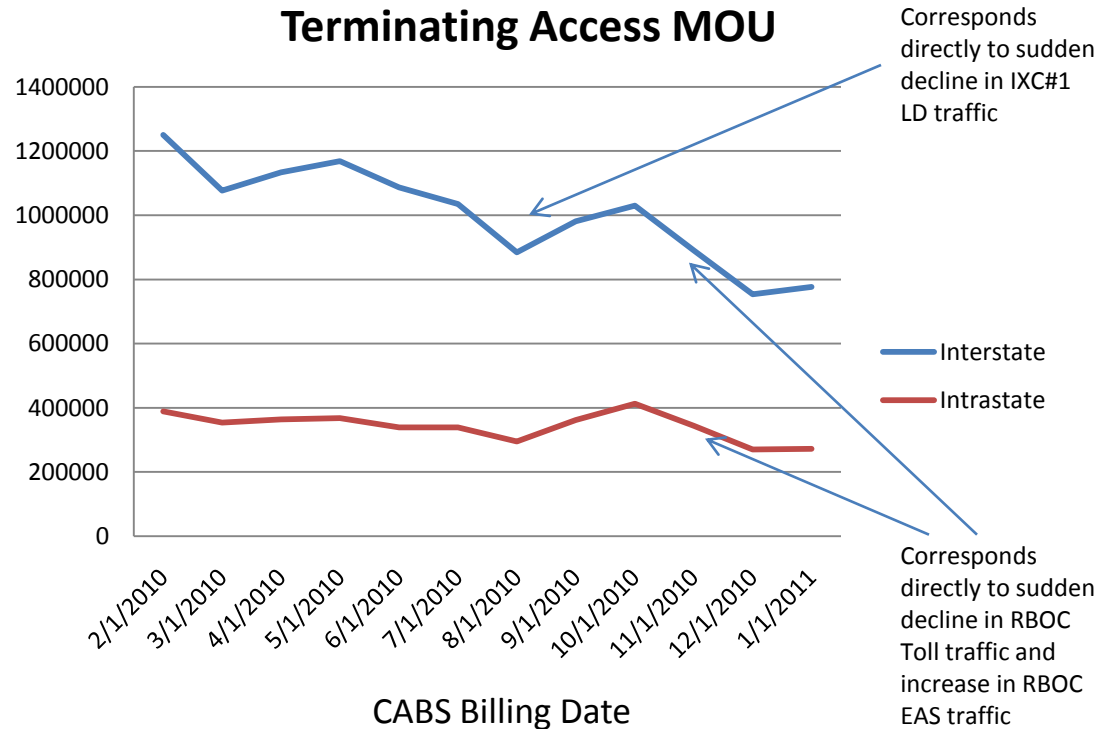
- 17.73% decrease in Interstate MOU
- 13.47% decrease in Intrastate MOU
- Total revenue decrease >\$8,000 for July terminating access traffic

## October (November 1 bill date)

- 33.74% decrease in Interstate MOU
- 30.92% decrease in Intrastate MOU
- Total revenue decrease for the month of October > \$10,000

## November (December 1 bill date)

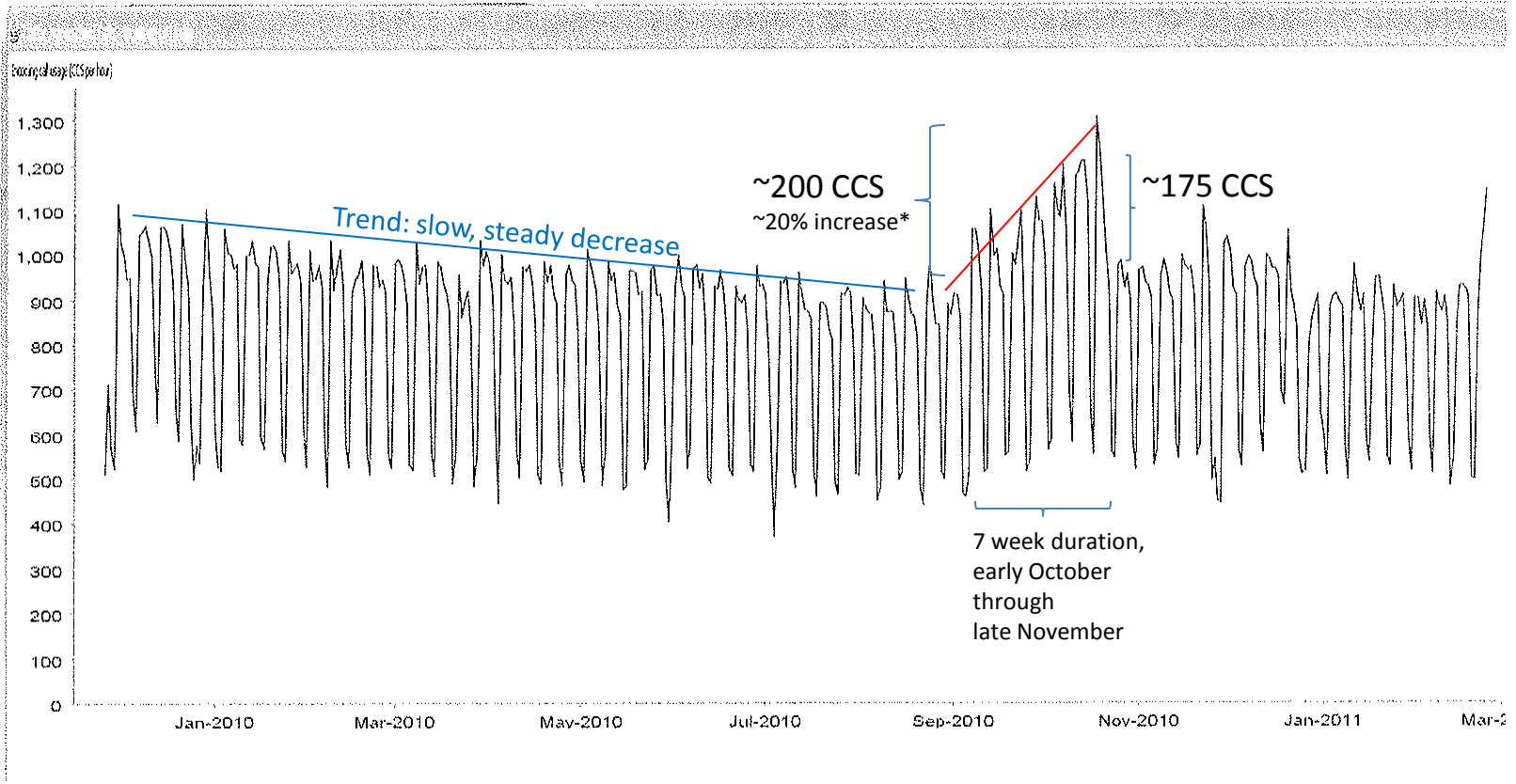
- 32.35% decrease in Interstate MOU
- 44.05% decrease in Intrastate MOU
- Total revenue decrease for the month of November > \$10,000



The IXCs may argue that our terminating access MOU is due to our declining access line count, but our access line count remains largely unchanged from Jan 2010 (9,548) through Jan 2011 (9,553). More importantly, the data shows LCR is the most likely cause . . .

# Probable Indicator of LCR

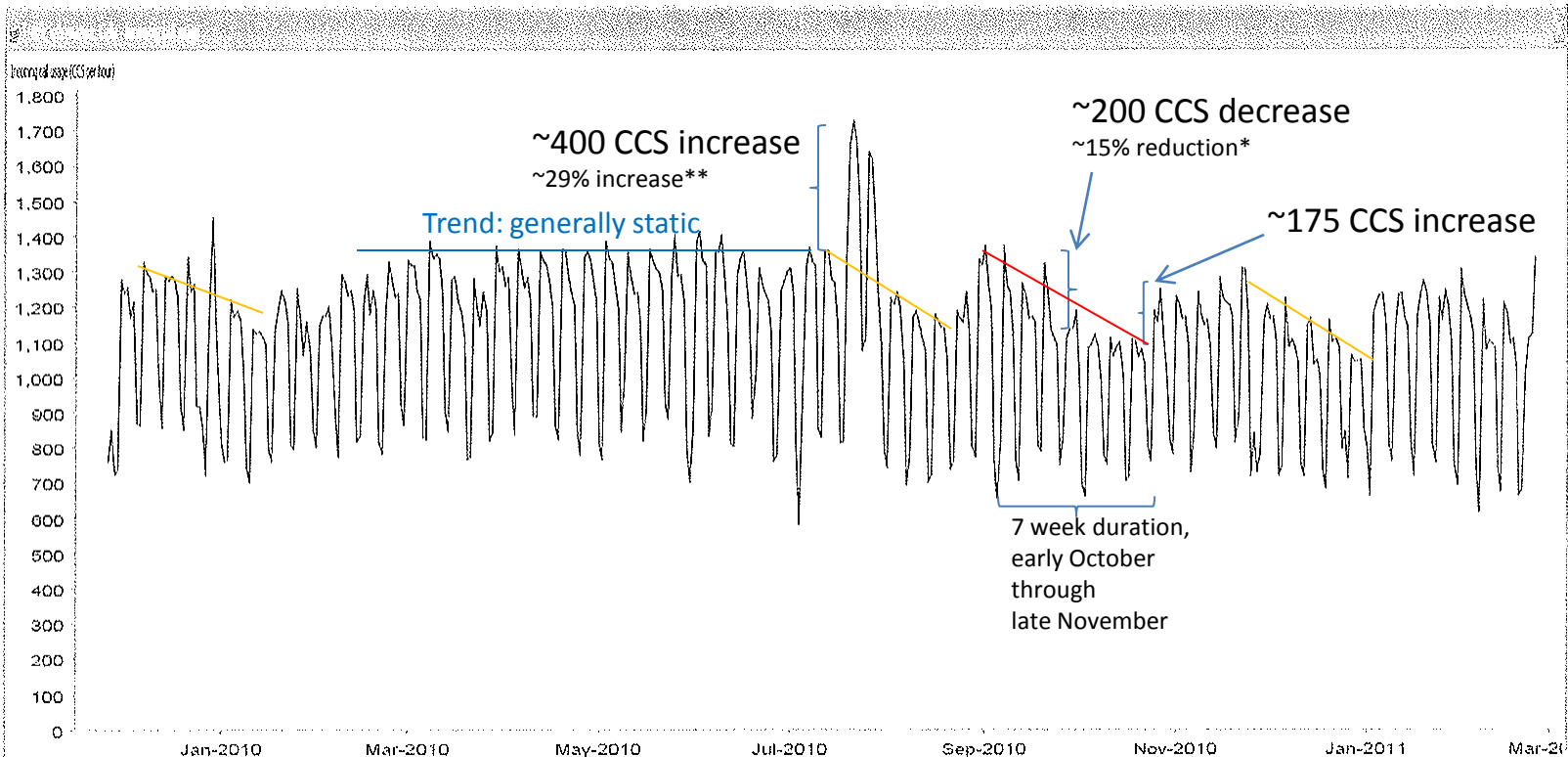
EAS Trunk Group from RBOC



\* We observed a sharp decline in toll terminating access (and CABS revenue) for October & November 2010, directly proportional to the sudden increase in EAS terminating traffic.

# Possible Indicators of LCR

## RBOC Toll Trunk Group, Terminating traffic to Canby

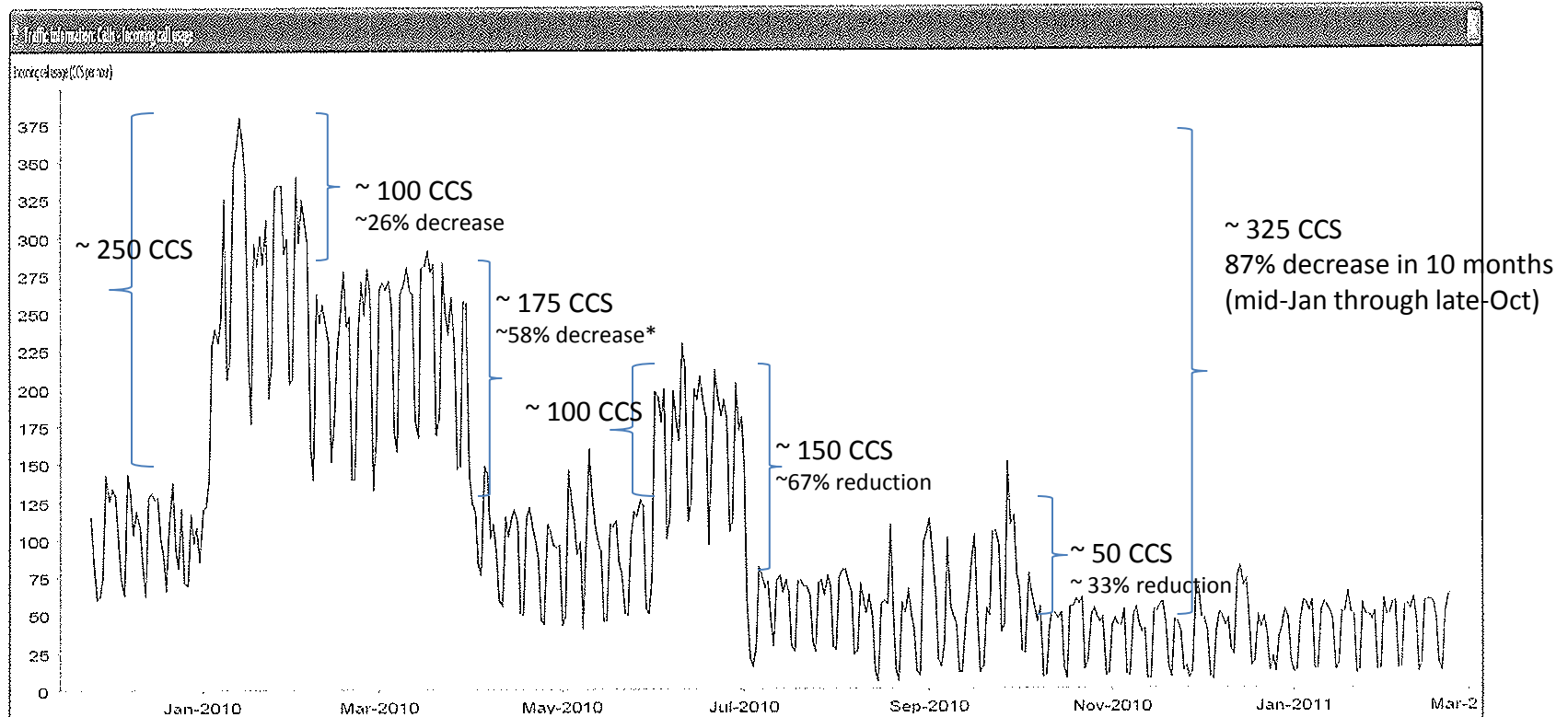


\*Note the ~200 CCS decrease occurs at the same time (early October) as the corresponding increase in EAS traffic at the same time (previous slide). RBOC toll traffic increases in early December at the same time the EAS traffic declines. Both changes are directly proportional to the changes in EAS traffic.

\*\*Sharp increase in RBOC Toll traffic for 2 weeks in August indicates possible spike in overflow from another carrier's trunk group? IXC#1, IXC#2, and IXC#3 don't appear to be the cause.

# Probable Indicators of LCR

IXC#1 Long Distance TG Terminating traffic to Canby

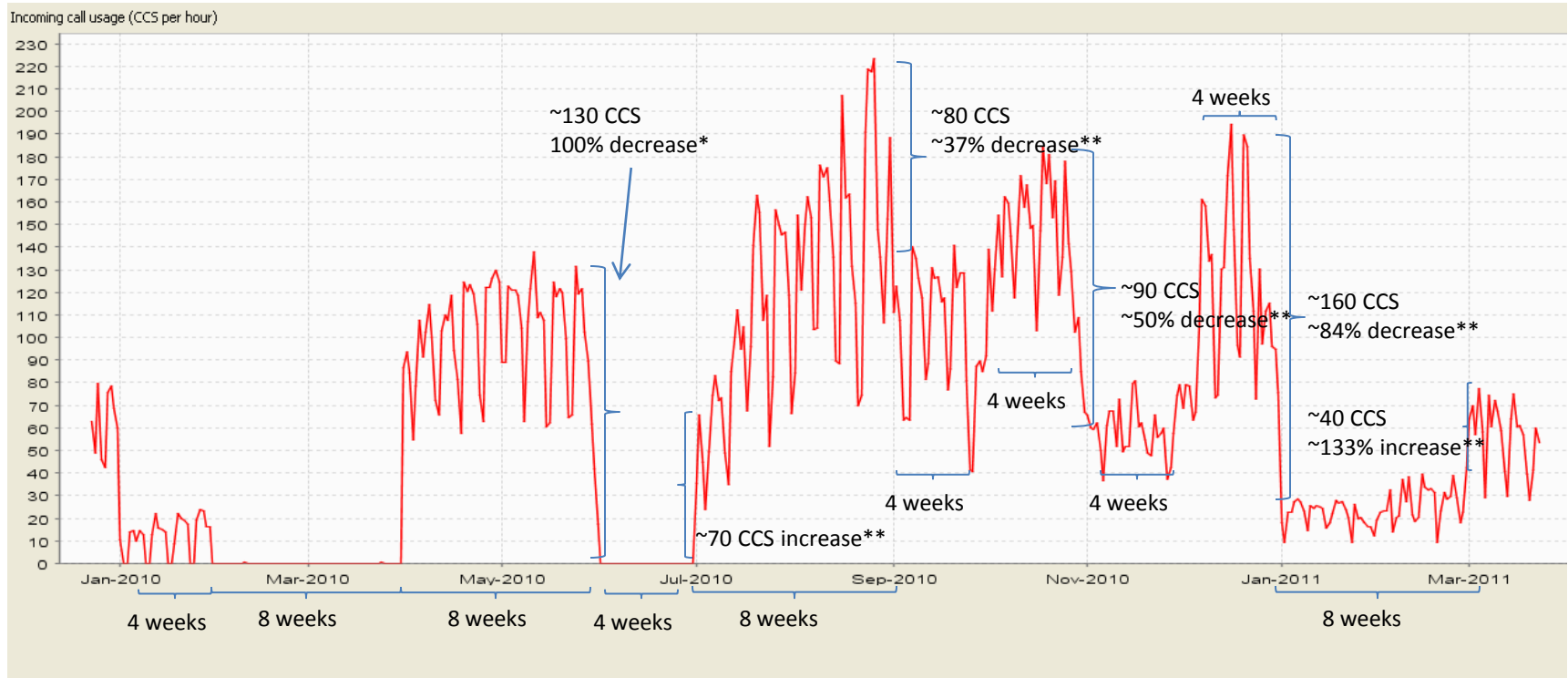


These extremely abrupt changes in traffic are highly unusual and based on the change in CCS, are strong indicators of changes to call routing. The magnitude of these changes could indicate implementation of LCR on individual trunks at different times. Normal attrition would show a consistent, uniform decline. The magnitude of the overall reduction in a 10 month period is unprecedented and highly abnormal.

\* IXC#1 issued a disconnect for two trunks (24 members each) in March 2010

# Probable Indicators of LCR

## IXC#2 Toll TG Terminating traffic to Canby

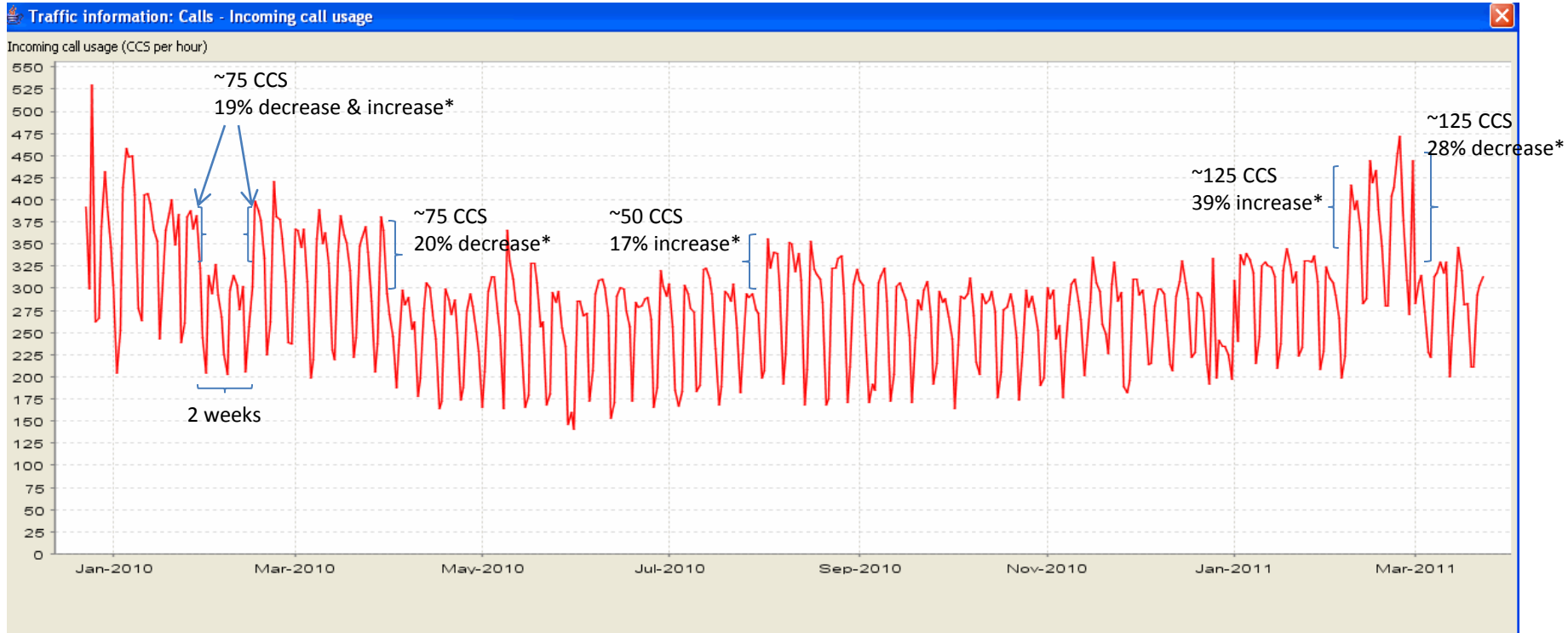


\*IXC#2 issued a disconnect of one of two 24-member circuit, but re-pointed all traffic to the other existing circuit, so we should not have seen any significant change in total traffic, and certainly not a 100% decrease from IXC#2. 130 CCS drop in traffic for 1 month, followed by a sudden 70 CCS spike and 300% increase clearly indicates routing changes. We have not yet determined where this traffic went, but we know IXC#2 did not stop sending us traffic for a month.

\*\* Extremely unusual, abrupt fluctuations in traffic at the start/end of calendar months clearly indicates changes to routing.

# Probable Indicators of LCR

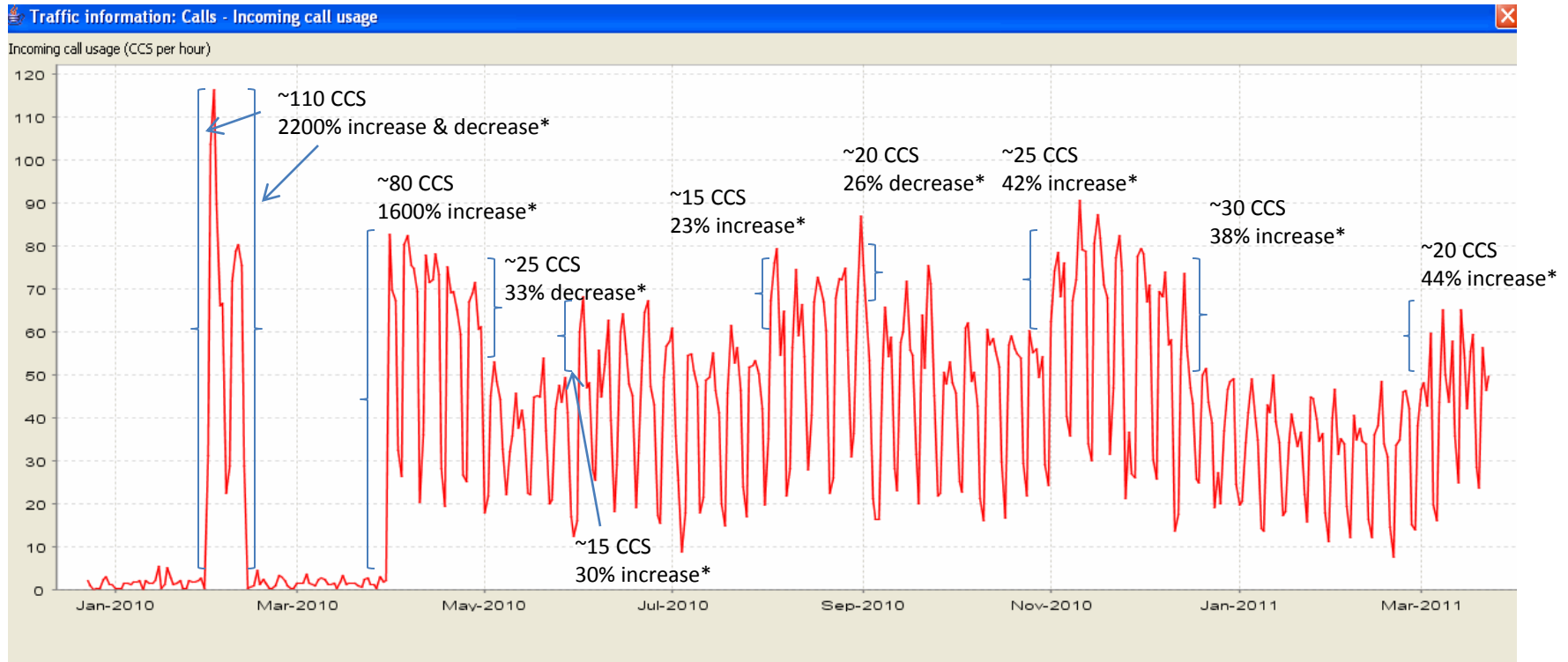
IXC#3 Toll TG Terminating traffic to Canby



\*Probable indication of LCR. Extremely unusual, abrupt fluctuations in traffic at the start/end of calendar months clearly indicates changes to routing.

# Probable Indicators of LCR

## IXC#4 Toll TG Terminating traffic to Canby



\*Probable indication of LCR. Extremely unusual, abrupt fluctuations in traffic at the start/end of calendar months clearly indicates changes to routing. We have not been able yet to identify where the late December-mid January and mid February-end of March traffic was re-routed.

Note recurring 4-5 week pattern at the beginning / end of the calendar month when routing changes appear

# Other Aspects of LCR:

## One Example (971) 230-xxxx\*

This number is an aggregation point for Interstate and Intrastate calls from a variety of IXC's actively utilizing LCR, and from a variety of VoIP providers to actively circumvent PSTN call routing to intentionally avoid payment of toll terminating access

During the week of January 23, 2011:

- Canby Telcom received a total of 513,836 inbound calls from 69,481 unique TNs throughout North America
- 27,082, or 5.27% of the total inbound calls, had a Charge Number of (971) 230-xxxx and were routed to Canby via the RBOC Tandem (Portland), but actually originated at TNs from across North America. *Only one of these 27,082 calls included a CIC code.*
- Calls originating from Google Voice, at least one RBOC, Vonage, and possibly other carriers route "through" this number to the RBOC tandem.
- This number is part of a 1000 block owned by a registered CLEC, and is from the RBOC PTLDOR18DS0 switch

Note: The next 10 highest originating TNs of calls to our two switches are all large local businesses

\* The switch shows 971-230-xxxx as the "Calling DN" for all 27,082 calls. More detailed analysis shows 971-230-xxxx is the "Charge Number" for all of these calls, but the actual Calling Party Number (CPN) is a different number (where it was not stripped off or spoofed).

# Other Aspects of LCR:

One Example (971) 230-xxxx

## Machinegun Effect:

Calling DN	Called DN	Call Initiated	Call Connected	Call Ended	Call Duration	Initiated to End	Inbound TG#
971230xxxx	503263xxxx	01/23/11.00:27:51	No	00:27:51	0:00:00	0:00:00	38
971230xxxx	503263xxxx	01/23/11.00:27:56	No	00:27:57	0:00:00	0:00:01	38
971230xxxx	503263xxxx	01/23/11.00:27:59	No	00:27:59	0:00:00	0:00:00	38
971230xxxx	503263xxxx	01/23/11.00:28:12	No	00:28:12	0:00:00	0:00:00	38
971230xxxx	503263xxxx	01/23/11.00:28:34	No	00:28:34	0:00:00	0:00:00	38

Total Elapsed Time: 43 seconds

Inbound Trunk 38 = RBOC Toll

Calling DN = Charge Number in the call trace. CPN can only be identified by analyzing individual calls

# Examples of LCR

All of the following calls were routed to Canby on TG 38 (RBOC Toll Tandem) in a 1-hour period in a single day. Our switch logged 408 inbound calls from 971-230-xxxx in this 1-hour period.

Originating TN	Charge Number*	Terminating TN
480-837-7xxx	<b>971-230-xxxx</b>	503-266-7xxx
541-491-1xxx	<b>971-230-xxxx</b>	503-651-2xxx
<b>200-200-0000</b>	<b>971-230-xxxx</b>	503-651-3xxx
209-800-1xxx	<b>971-230-xxxx</b>	503-263-2xxx
<b>200-200-0000</b>	<b>971-230-xxxx</b>	503-651-3xxx
972-331-9xxx	<b>971-230-xxxx</b>	503-651-3xxx
<b>000-000-0000</b>	<b>971-230-xxxx</b>	503-266-7xxx
406-948-8xxx	<b>971-230-xxxx</b>	503-263-6xxx

## Illegally Spoofed Numbers:

54 of the 408 calls From 971-230-xxxx Have 200-200-0000 as the originating TN

000 and 200 are not valid NPAs. The real originating TNs have been manipulated. Other examples include (blank), 000, or just the NPA

## LCR = Phantom Traffic

None of these calls generates a billing record because they all have a local (Portland) Charge Number, no OCN, and no CIC

\* (971) 230-xxxx belongs to a 1000s block owned by a registered CLEC

# Misuse of Charge Number

CC Docket No. 91–281, FCC 95–187

## § 64.1600 Definitions.

- (b) *ANI*. The term “ANI” (automatic number identification) refers to the delivery of the calling party’s billing number by a local exchange carrier to any interconnecting carrier for billing or routing purposes, and to the subsequent delivery of such number to end users.
- (c) *Calling party number*. The term Calling Party Number refers to the subscriber line number or the directory number contained in the calling party number parameter of the call set-up message associated with an interstate call on a Signaling System 7 network.
- (d) *Charge number*. The term “charge number” refers to the delivery of the calling party’s billing number in a Signaling System 7 environment by a local exchange carrier to any interconnecting carrier for billing or routing purposes, and to the subsequent delivery of such number to end users. (emphasis added)

Using the Charge Number to disguise the origin or jurisdiction of a call or to avoid interstate terminating access charges is a violation of Part 64. Our test calls demonstrate that (971) 230-xxxx is clearly not the calling party’s billing number.

# Spoofting is Illegal

CC Docket No. 91–281, FCC 95–187

## § 64.1601 Delivery requirements and privacy restrictions.

(a) *Delivery.* Common carriers using Signaling System 7 and offering or subscribing to any service based on Signaling System 7 call set functionality are required to transmit the calling party number associated with an interstate call to interconnecting carriers.  
(emphasis added)

The burden to authenticate and transmit an accurate calling party number lies with the carrier who originated the call. It is our contention that it is a violation of Part 64 for a carrier to transmit incomplete, missing, or invalid / unauthenticated CPNs

# Charge Number Services

CC Docket No. 91–281, FCC 95–187

## § 64.1602 Restrictions on use and sale of telephone subscriber information provided pursuant to automatic number identification or charge number services.

- (a) Any common carrier providing Automatic Number Identification or charge number services on interstate calls to any person shall provide such services under a contract or tariff containing telephone subscriber information requirements that comply with this subpart. *Such requirements shall:*
- (1) Permit such person to use the telephone number and billing information for billing and collection, routing, screening, and completion of the originating telephone subscriber's call or transaction, (emphasis added)

Q: Is the owner of (971) 230-xxxx offering Charge Number services under a contract or tariff?

64.1602 thereby also requires carriers to authenticate / validate the calling party's number contained in the P-Charge Info or similar information in the SIP INVITE message for all VoIP calls, and to transmit it in order for carriers to determine the Calling Party Number

# Consumer Comments About (971) 230-xxxx

- “I have been receiving about 4 phone calls a day from this number. It comes up in my comcast call list as: Wales R & P...or TN Removal List...or Sales Dept. But most of the time it comes up as Unknown. When I tried to call the number back it says it is no longer in service.”
- “On my Phone Caller ID it said (360) 464-2xxx Olympia WA but phone bill call record shows the number is (971) 230-xxxx.”
- “Keep getting these calls from different numbers. This one shows on caller ID as NY,NY 212-999-8xxx, but on my itemized bill, same call, same time, shows NY, NY 971-230-xxxx. Recorded message in Spanish. They are call spoofing.”

# Consumer Comments About (971) 230-xxxx

- “Different people from this number call 2-3 times a day asking for "Linda", they hang up when told there is no Linda here. Number when called back says its out of order.”
- “Keep getting a phone call, but no answer from 971-230-xxxx how do I get this to stop? Caller ID: 971-230-xxxx”

# Other Examples of LCR

## Google Voice

Call from (503) 592-xxxx (Google Voice)\*  
to (503) 651-xxxx (CTA test line)

- Call terminates to Canby on RBOC toll TG
- 971-230-xxxx appears as the Charge Number in the switch
- Another detailed report shows the Calling Party Number (CPN) is (503) 592-xxxx
- **No AMA record generated. No CDR. Call trace shows no OCN or CIC.**

\* (503) 592-xxxx is a Canby-Needy exchange number belonging to bandwidth.com, LLC, a registered CLEC

Call from (971) 208-xxxx (Google Voice)\*  
to (503) 651-xxxx (CTA test line)

- Call terminates to Canby on RBOC toll TG
- 971-230-xxxx appears as the Charge Number in the switch
- Another detailed report shows the CPN is (971) 208-xxxx
- **No AMA record generated. No CDR. Call trace shows no OCN or CIC**

\* (971) 208-xxxx is Salem number belonging to bandwidth.com , LLC, a registered CLEC

# Other Examples of LCR Vonage

The following call was routed to Canby on TG 38 (RBOC Toll Trunk Group).

Call from (520) 232-xxxx (Vonage customer in Tucson, AZ, but who physically placed a test call from **Mexico** using his Vonage ATA) to (503) 651-xxxx (CTA test line)

- Call terminates to Canby on RBOC Toll TG
- 971-230-xxxx appears as the Charge Number
- Another detailed report shows (520) 232-xxxx as the CPN

\* (971) 230-xxxx belongs to a 1000s block belonging to a registered CLEC

# Other Examples of LCR Ooma

The following call was routed to Canby on TG 99 (**RBOC EAS\* Trunk Group**).

Call from (520) 529-xxxx (Ooma customer in Tucson, AZ, who physically placed a test call from Tucson using his Ooma ATA) to (503) 651-xxxx (CTA test line)

- Call terminates to Canby on RBOC **EAS** trunk group
- (520) 529-xxxx appears as the CPN and as the Charge Number

\* Mis-routing over the EAS trunk group indicates LCR

# Customer Symptoms of LCR

## Fax Problems

**Problem:** Canby Telcom end user (POTS) customers are increasingly reporting consistent problems receiving fax transmissions from specific customers outside the Canby serving area and/or from customers served by specific carriers outside of Canby.

- Sending and receiving fax machines cannot negotiate a stable baud rate, sending machine terminates the transmission due to excessive packet retransmission
- Sending fax machine cannot detect fax tones from receiving fax machine, terminates the transmission

Fax troubles have spiked in late January into early March, then disappeared. They suddenly began again in mid-June.

# Examples of Fax Troubles Due to LCR

Test calls to a single Canby end-user small business customer.

Calling Party Number	Charge Number	Terminating TN	Initiated	Connected	Ended	Duration	Trunk Group	Fax Status
602-863-xxxx	971-230-xxxx *	503-651-xxxx	14:14:33	14:14:37	14:15:05	00:00:28	RBOC EAS*	Failed
602-863-xxxx	602-863-xxxx*	503-651-xxxx	14:13:08	14:13:12	14:13:30	00:00:18	RBOC EAS*	Failed
602-863-xxxx	602-863-xxxx*	503-651-xxxx	08:28:28	08:28:32	08:30:00	00:01:28	IXC#3 Toll*	Failed
480-924-xxxx	480-924-xxxx	503-651-xxxx	12:50:04	12:50:08	12:51:05	00:00:57	RBOC Toll	Failed

\* Concrete evidence of LCR = routing through a suspected aggregator of calls converted to IP and calls from nomadic VoIP providers, and mis-routed over RBOC EAS trunk group and other trunk groups belonging to IXCs suspected of using LCR providers.

The 602-863 customer uses a VoIP provider for local service, and is a likely candidate for having calls routed via LCR. The 480-924 customer said her local provider and LD carrier is RBOC.

To troubleshoot, we took one of our own fax machines to the customer and re-attempted test faxes from the same 602-863 number, and those fax transmissions failed. We took our fax machine back to our offices and were able to send & receive faxes to her machine from ours (all successful). This confirms that her fax machine, our fax machine, and the local network are not part of the fax problem. That troubleshooting and the data above confirm that LCR (IP transit) is the most likely culprit.

# Troubleshooting

Canby Telcom switch / transport technicians:

- tested & verified line quality
- tested Inside Wiring (IW) to 1Gbps
- Verified proper filter placement & function (DSL customers)
- Verified proper, error-free receipt of test faxes from local fax machines\*
- Replaced the customer fax machine with one of Canby Telcom's fax machines, and verified fax transmission failure from the same senders.\* One sender in Arizona confirmed he is using a VoIP service. Another sender in Arizona reported her service provider is RBOC.
- Captured call traces on fax calls from these senders to the Canby end users, *confirming at least some of these fax calls are subject to LCR*

\* To eliminate TDM to IP conversion or IP compression and verify the receiving fax machine and recipient's network are functioning properly for fax transmission / receipt.

# Customer Frustration With LCR

3/22/11 data provided by one of our customers from their fax server (Trunk Group is Canby data).

**64% Failure Rate for Incoming Faxes**

NPA	NXX	Rate Center	OK/Fail	Inbound Trunk Group
215	947	Philadelphia, PA	OK	No Call Record*
215	997	Line Lexington, PA	FAILED	RBOC EAS*
217	543	Arthur, IL	FAILED	RBOC EAS*
352	671	Ocala, FL	FAILED	No Call Record*
503	642	Beaverton, OR	FAILED	RBOC EAS
503	642	Beaverton, OR	OK	RBOC EAS
503	642	Beaverton, OR	OK	RBOC EAS
503	642	Beaverton, OR	OK	RBOC EAS
518	877	Jonesville, NY	FAILED	No Call Record*
585	657	Holcomb, NY	FAILED	RBOC EAS*
610	279	Philadelphia, PA	FAILED x2	IXC#3 Toll**
612	866	Twin Cities, MN	FAILED	No Call Record*
617	497	Cambridge, MA	OK	IXC#2 Toll
619	233	San Diego, CA	OK	RBOC TOLL
631	582	Central Islip, NY	FAILED	RBOC EAS*
631	582	Central Islip, NY	OK	RBOC EAS*
682	564	Arlington, TX	OK	RBOC EAS*
701	255	Bismarck, ND	FAILED	RBOC EAS*
713	773	Houston, TX	OK	RBOC EAS*
717	939	Harrisburg City, PA	FAILED	RBOC EAS*
724	754	Canonsburg, PA	FAILED	IXC#3 Toll**
760	327	Palm Springs, CA	FAILED x2	IXC#3 Toll**
813	626	Tampa, FL	FAILED	RBOC EAS*
905	761	Thornhill, ON Canada	FAILED	No Call Record*
928	854	Lake Havasu City, AZ	OK	RBOC EAS*
989	755	Saginaw, MI	FAILED	RBOC EAS*

\*Strong evidence of LCR: calls mis-routed through the RBOC Local Tandem / EAS trunk instead of through the appropriate toll trunk group / RBOC Toll Tandem, or no call detail record generated in the switch for an Interstate call

\*\* Possible evidence of LCR: calls correctly routed to a plausibly appropriate toll trunk group, but failing

We later sent 10 test faxes to this customer's 4 fax numbers (fax machines and fax server), and all 10 completed successfully, demonstrating their fax machine and server are working flawlessly and affirming that the most likely culprit is fax transiting LCR (IP) networks.

# LCR Issues are Pervasive

Trouble reports January 1, 2011 through March 1, 2011

- Business experiencing “fading” and can barely hear when called by customer in Salem (503) 589
- Business having trouble receiving faxes from (541) 382
- Business incoming faxes unable to connect successfully. Local to local test faxes work fine.
- Business unable to receive faxes from VoIP systems or SIP phones including (337) 981, (214) 352, (516) 681. Fax errors out with “bad connection” or unable to connect.
- Business cannot receive faxes from customer at (925)-820. Originating caller says they “always have problems faxing to 503 Area Code”. Multiple reports (same originating & terminating numbers)
- Business having “ongoing” issues with receiving faxes from CA.
- Business receiving multiple unsuccessful incoming fax attempts from (480)-924 two seconds apart. Cannot consistently send faxes to this same number. AZ customer has VoIP system? Multiple reports (same originating & terminating numbers)
- Business unable to receive faxes from customer (503) 708. Local to local test faxes work fine.

# LCR is an Increasing Problem for Customers

- LCR = converting PSTN calls (and fax transmissions) to IP packets and routing calls over IP networks, rather than TDM networks
- VoIP compression algorithms, like the most common ITU G.729 standard, reduce bandwidth required for voice calls by heavily compressing the voice content. This compression creates excessive packet loss that fax machines cannot correct, so fax transmissions consistently fail at a high rate whenever they originate, transit, or terminate a VoIP / SIP network.
- Even “uncompressed” VoIP algorithms like the ITU G.711 standard cause high failure rates in fax transmissions
- Since LCR involves an IXC converting PSTN traffic to IP, LCR inherently causes high failure rates in fax transmissions.
- Businesses that rely heavily upon fax transmissions for commerce or rely upon detailed imagery faxes will be increasingly adversely affected as more carriers implement LCR!!!

# LCR: CALEA and 911

- LCR inhibits service providers from complying with Lawful Intercept orders (CALEA) in cases where the Calling Party Number (CPN) is incomplete, missing, or spoofed
- LCR could pose a risk to life and limb in cases where a caller places a 911 call and the Calling Party Number (CPN) is incomplete, missing, or spoofed
  - 911 test call using Google Voice: Recorded Announcement: “This number is not available for call return. Goodbye.”

Our most recent data shows that 3.2% of all incoming calls had a missing, incomplete, or spoofed CPN. That equates to more than 64,000 calls per month.

# Supplemental Data to Least Cost Routing Presentation

June 14-17, 2011

# June 13-17, 2011

- 312,495 incoming calls received
- 7,636 calls from (971) 230-xxxx = 2.44% of total
- 10,023 calls from spoofed or blank originating numbers = 3.21% of total

# June 13-17, 2011

## Terminating EAS Trunk Group Traffic

- 80,504 calls on EAS Trunk Group
  - 13,301 (16.5%) are from NPA/NXX other than 503 or 971
    - Not one of these interLATA call records includes a CIC
    - 793 (1.0%) are from NPA 541
    - 6,870 (51.7%) are from spoofed or incomplete calling numbers

# Intrastate Calls over EAS

CPN	Called Party	Date/Time
541595xxxx	503266xxxx	06/13/11.21:56:20
541647xxxx	503263xxxx	06/13/11.22:06:30
541677xxxx	503266xxxx	06/13/11.22:05:21
541403xxxx	503263xxxx	06/13/11.22:11:38
541840xxxx	503263xxxx	06/13/11.22:14:53
541636xxxx	503310xxxx	06/13/11.22:17:59
541447xxxx	503266xxxx	06/13/11.22:19:07
541276xxxx	503266xxxx	06/13/11.22:21:55
541757xxxx	503266xxxx	06/13/11.22:32:07
541408xxxx	503266xxxx	06/13/11.22:34:50
541926xxxx	503651xxxx	06/13/11.23:07:59
541937xxxx	503266xxxx	06/13/11.22:47:48

793 calls, June 13-17 2011

# Interstate Calls over EAS

CPN	Called Party	Date/Time
202607xxxx	503266xxxx	06/13/11.21:59:55
407545xxxx	503263xxxx	06/13/11.21:59:43
408427xxxx	503266xxxx	06/13/11.22:00:47
206335xxxx	503651xxxx	06/13/11.21:58:07
406586xxxx	503263xxxx	06/13/11.22:01:24
312878xxxx	503266xxxx	06/13/11.22:12:20
307347xxxx	503651xxxx	06/13/11.22:12:56
319242xxxx	503266xxxx	06/13/11.22:15:11
209943xxxx	503263xxxx	06/13/11.22:15:10
518326xxxx	503266xxxx	06/13/11.22:00:14
661203xxxx	503266xxxx	06/13/11.22:00:36

CPN	Called Party	Date/Time
623680xxxx	503266xxxx	06/13/11.22:00:11
702339xxxx	503651xxxx	06/13/11.21:59:48
707786xxxx	503263xxxx	06/13/11.21:59:48
757209xxxx	503266xxxx	06/13/11.22:02:53
717543xxxx	503651xxxx	06/13/11.21:56:22
585314xxxx	503266xxxx	06/13/11.22:02:50
602547xxxx	503651xxxx	06/13/11.22:04:21
509735xxxx	503266xxxx	06/13/11.22:04:34
715647xxxx	503266xxxx	06/13/11.22:02:30
951244xxxx	503263xxxx	06/13/11.21:26:05
989550xxxx	503266xxxx	06/14/11.03:17:07

5638 calls, June 13-17 2011

# Spoofer or Incomplete CPN Calls over EAS

CPN	Called Party	Date/Time
101	503651xxxx	06/13/11.22:36:30
0	503266xxxx	06/13/11.22:55:28
6055	503266xxxx	06/13/11.23:04:19
23330964	503651xxxx	06/14/11.14:21:55
229380819	503263xxxx	06/14/11.14:36:20
503142310	503263xxxx	06/15/11.03:10:42
91659	503263xxxx	06/15/11.18:31:36
9999999999	503263xxxx	06/14/11.15:18:21
-	503266xxxx	06/13/11.22:03:34
-	503651xxxx	06/13/11.22:04:30

6870 calls, June 13-17 2011

# June 13-17, 2011

## Terminating RBOC Toll Trunk Group Traffic

- 55,928 calls on RBOC Toll Trunk Group
  - 52,599 (94.0%) have no CIC
  - 7636 (13.7%) are from Charge Number (971) 230-xxxx
  - 229 (0.4%) are from spoofed or incomplete calling numbers

# Least Cost Routing Analysis Follow-up: Intrastate Toll

Brandon Zupancic

Canby Telcom

April 19, 2011

# Background

- Canby Telephone Association does not have any EAS trunks to any exchange in LATA 670 or 676 (NPA 541)
- All IntraState traffic from (541) should be delivered to Canby on the appropriate Intrastate Toll trunk group
- No IntraState traffic from (541) should arrive to Canby on an EAS trunk group

# IntraState Toll Access Avoidance Data

- Data is from the week of January 23, 2011
- 4,164 calls originating from NPA 541
- 29.4% (1,223) of these calls were routed to Canby on the EAS trunk group
  - Canby examined 395 calls from 13 of the 20 NPA/NXXs with the highest number of calls to Canby
    - 31 calls appear to be from Wireless Carrier #1 in Pendleton (Outside the Portland / Oregon MTA)
    - 10 calls appear to be from Wireless Carrier #2 in Pendleton (Outside the Portland / Oregon MTA)
  - Other calls from 541 routed over EAS trunk group would require assistance from the RBOCs and CLEC #1 to determine which carriers these numbers were ported to.
- None of the 1,223 calls included a CIC code
- In addition to the 4,164 calls originating from NPA 541, an additional 373 calls appear in the switch with a manipulated originating DN, preventing determination of proper jurisdiction or actual origin
  - 280 calls have a Calling Party Number of 000-000-0000
  - 93 additional calls have an Calling Party Number of 1, 1203, 11419, 123-456-7890, etc.

# Examples of Intrastate Toll Mis-routing (?)

## Wireless Carrier #1

Week of January 23, 2011

NPA/NXX	Switch / Location	# Calls	CIC transmitted?	Notes
(541) 310	Pendleton*	31	None	21 calls from (541) 310-xxxx
Total		31	None	

These calling numbers belong to the Spokane-Billings MTA.

# Examples of Intrastate Toll Mis-routing (?)

## Wireless Carrier #2

Week of January 23, 2011

NPA/NXX	Switch / Location	# Calls	CIC transmitted?	Notes
(541) 379	Pendleton	10	None	All calls from (541) 379-xxxx
Total		10	None	

These calling numbers belong to the Spokane-Billings MTA.

# Examples of Intrastate Toll Mis-routed over EAS RBOC #2

Week of January 23, 2011

NPA/NXX	Switch / Location	# Calls	CIC transmitted?	Notes
(541) 565	Moro	18	None	15 calls from (541) 565-xxxx
(541) 994	Lincoln City	26	None	All calls from (541) 994-xxxx
(541) 996	Lincoln City	30	None	21 calls from (541) 996-xxxx
Total		<b>74</b>	<b>None</b>	

The calling numbers are all ported from RBOC #2, but we do not know whether they are ported to a wireless carrier, CLEC, or other.

# Examples of Intrastate Toll Mis-routed over EAS

## RBOC # 2

Week of January 23, 2011

NPA/NXX	Switch / Location	# Calls	CIC transmitted?	Notes
(541) 544	Wamic WAMCORXBDSO	48	None	45 calls from (541) 544-xxxx
(541) 575	John Day JHDYORXADS0	14	None	All calls from (541) 575-xxxx
Total		62	None	

The calling numbers are all ported from RBOC #2, but we do not know whether they are ported to a wireless carrier, CLEC, or other.

# Examples of Intrastate Toll Mis-routed over EAS RBOC #1

Week of January 23, 2011

NPA/NXX	Switch / Location	# Calls	CIC transmitted?	Notes
(541) 485	Eugene EUGNOR53DS1	31	None	10 calls from (541) 485-xxxx
Total		31	None	

The calling numbers are all ported from RBOC #1, but we do not know whether they are ported to a wireless carrier, CLEC, or other.

# Examples of Intrastate Toll Mis-routed over EAS CLEC #1

Week of January 23, 2011

NPA/NXX	Switch / Location	# Calls	CIC transmitted?	Notes
(541) 762	Eugene	10	None	All calls from (541) 762-xxxx
Total		10	None	

The calling numbers are all ported from CLEC #1, but we do not know whether they are ported to a wireless carrier, CLEC, or other.

# Learn More. Do More.

Faxing Issues with IP Transit (while specifically about fax over VoIP, the same issues apply whether a fax transmission originates, transits, or terminates on an IP network)

<http://www.voipmechanic.com/faxingissuesandotherdevices.htm>

NECA, NTCA, WTA, and OPASTCO are all currently working with member companies and the FCC Enforcement Bureau and the FCC Policy Pricing Division, but need the active involvement, data, and examples from other telcos, end user customers, state associations, and state PUCs/PSCs.

# Conclusion

“Least Cost Routing” directly generates at least a portion of Phantom Traffic and Toll Fraud. Illegal spoofing is increasingly prevalent with calls routed via an LCR provider.

LCR Causes direct financial harm to end user businesses and consumers nationwide, and every service provider who serve them (whether ILEC, CLEC, or cable provider)

# Other Comments

From ILECs, RLECs, and CLECs across  
the country on a private forum

# New England

“In New England, we have been experiencing an intermittent problem with incoming calls not reaching our network. A interstate caller makes a call to our NXX and gets dead-air and then fast busy. There is no SS7 messaging showing up on my switch. It is difficult to trace, because it doesn't hit our network. It appears to be a problem with LCR (least cost routing). It appears to only be on interstate calls. This problem has been going off and on since December 2009.”

“The Telephone Association of New England has started an active committee for joint troubleshooting in our area. The committee is working on a matrix of different carriers, contact phone numbers, and joint trouble reporting. We suspect that the problem is with LCR or a conversion or loss packet issue with IP.

This is a very frustrating situation and national associations and regulators are going to have to step in. ”

# Wisconsin

“We are having the same problems in Northern Wisconsin the last several weeks. We have Interstate calls that are bad as well as Intrastate (Inter and Intra LATA) as well. Some calls hit our switch but, the caller cannot hear or the delay or echo is so bad a conversation cannot be had.

The only remedy we've seen work is to open Trouble Tickets with the Originating callers and their LD Carriers. It is a time-consuming process and the results seem to be only temporary. This has been very frustrating for us and our customers as well.

We noticed the problem has been bad on / off since the end of 2009 as well.”

# Utah

“Our customers call and complain they are not getting all their calls, their phone rings and no one is there, or maybe the calling party into our network will hear 10 rings and the called party on our network hears only one ring and fast busies. The problem was so bad a year ago on our network we were able to isolate the problem to RBOC. We would call RBOC and nothing would change. Our Attorney's finally had to contact RBOC to get something done, the problem would be fixed for a while they would start using LCR again and things would start failing, after months they finally either quit with LCR, which I doubt or they figured out their problem.

Now however we are having the issue quite frequent and I believe most of our failures are from Verizon, WorldCom or AT&T. I got a customer to work with us a couple of months ago and finally found someone at Verizon to work with us and he admitted to having routing loops and call failures due to LCR. Our problem has gotten a little better, but it is still not good.

I have talked to both Verizon and Qwest about the ongoing problems and they both gave me the same answers "The calling party needs to contact their LD provider if they are having calling issues". Our service reps are now referring them back to their LD carriers and also generating a ticket so we can monitor the failures.

I am in Southern Utah and my [REDACTED] CSR confirmed this is also happening in Wyoming and Montana.”

# NY, NY

“We regularly see issues, but the problems seem to be related to which carrier we've selected as the IXC for a particular call, not the usage of LCR. We LCR extensively, and use it to bypass carrier issues of all types (as well as to find the cheapest route for a call).

The tier-1 IXCs that I deal with generally complete calls without any issues.

The tier-2 IXCs seem to have a lot of sporadic issues; in particular, a lot of it appears to be related to load or time of day, which implies (to me) that they have overflow routes which have problems. Not to name any names, but one of said carriers has a number in its name, and another is a franken-carrier that has built a national footprint largely out of acquisitions.

The one tier-3 which I keep around for laughs is a complete crapshoot.

Calls which are Intrastate in nature seem to fail more often than Interstate calls.

This feels like an ongoing decay process as the overall quality/reliability of the PSTN continues to go to crap (using the technical term).”

# Vermont

“Calls from our VT customers that would be destined for ILECS in VT [redacted], etc) that are sent to our upstream providers will get long PDD and typically call fails... sometimes if you just wait 11-40 seconds the call will go through. We are unable to prove it, but we suspect the same thing you do that they are least cost routing and the calls gets a low priority because its headed to an ILEC. When we send the calls to [redacted] Tandem the calls complete without issues. We end up doing it even if it's not the cheapest option because there is so consistently issues terminating calls if we pass it to another wholesale provider. We even have a issue where one of our wholesale providers uses our other wholesale provider, so in some cases the call would get PDD on either choice of routes.

For what it's worth, in our case it was very hard to get the alternate providers to address the issue because they did not want to terminate our intraLATA (VT) traffic. While this is not the case for calls coming from out of state, I believe that it's a percentage ratio perspective where other people are experiencing the same issues with calls ILECS were direct IXC connections are not present.”

# Nevada

“We have also experienced the same problem with calls terminating to our network. It has become a big problem within the 6 to 9 months. Is this an issue that we should raise with our trade associations, NECA, NTCA, NRTC, etc. Would others support me if I raised the issue?”

# Michigan

“Our Tandem switch is also a [REDACTED] and the carriers are all over the place. Our customers have been complaining for a long time and we have been unable to pin it down. The only thing we can point at is least cost routing.”

“[REDACTED] Communications in Michigan is experiencing the same problems as Casey at [REDACTED]. The "Machine Gun Effect" hit us so hard in the end of June that it busied out all of our trunks to our tandem. Since then we have limited the number of calls from the tandem in a five minute period to keep the flooding of our trunks to a minimum.”

# Colorado

“I don't think we've ever gotten a good explanation - one particular long-running problem we ultimately got resolved involved a Tier 1 and a two Tier 2 IXC carriers having issues calling a particular CLEC switch in Virginia. All of them made various "routing changes" to fix the problem. They clearly saw what was breaking, but cited NDA/contract restrictions and were unwilling to give me information about how they were changing their routing. The Tier 1 fix and one Tier 2 fix was permanent, but the other Tier 2 kept re-breaking so we ultimately rerouted on that end-office LRN away from the Tier 2 so we just never sent calls that way.

The SS7 messaging will usually show a "normal clearing" with a zero-length call. No useful messages or information seem to be propagated upstream to us.

I have a similar problem in Colorado right now in the Denver area, where Intrastate calls fail and Interstate calls work - over the same IXC (this is calling that's originating on my switch).”

# Georgia

“Our Metro-Atlanta customers have been experiencing these types of incoming call troubles off-and-on since the beginning of April. There have been three distinct “waves” of these issues. Even though we serve several rate centers in Georgia and Tennessee out of the same switches, only the Metro-Atlanta folks report this problem. I believe in my case the root cause is some Brand-X underlying carrier offering at times the Least-Cost-Route into the Atlanta area (to Atlanta NPA-NXXs).

The first wave was by far the worst lasting throughout April and into May. A customer would report receiving several sequential calls where the caller could not be heard at all. For example, let’s say a customer received five of these call attempts in a row. They would assume that they were missing five separate calls from five different callers or clients. You can imagine what this did to their patience and their attitude towards us. After collecting exact times and traces in our tandem – it turned out it wasn’t five callers after all. It was one caller, and while they were waiting to connect and couldn’t hear anything, our customer was receiving a barrage of bogus call attempts. I came to refer to this as “the machine-gun effect”. In many examples, each attempt would come through a separate established carrier like this for example -> 1)BellSouth - 2)AT&T - 3)Sprint – 4)AT&T - 5)Verizon, etc. Just as you all did, I tracked down the callers’ providers and carriers as best as I could. Many only wanted to hear from “their customers” (the originators). The ones who were willing to work with me would make routing changes and fix the problem – for a while. Often they would cite confidentiality agreements when I would inquire about their routes. Some reps would “slip-up” and share some information, and I remember hearing the names \_\_\_\_\_ and/or \_\_\_\_\_ more than once as underlying carriers.

Legal or not, it is wrong that a terminating service provider isn’t allowed to know the routes in which a call takes to get there. It ties your hands for troubleshooting and thus damages your reputation with your customers.

There was a second less brutal wave of it in June and a third in August. In those, the “machine-gun effect” didn’t seem to be as prevalent, but there were still one-way audio calls, no-way audio calls, and downright noisy calls. During those, it was impossible to narrow it down to a particular offending carrier. Hopefully, it will die off now or continue in smaller and smaller spurts until it does.

Through it all, it has been extremely difficult to keep our customers and their callers convinced that the issue is not in our network. For example, a customer reasons that a caller from New York has the same trouble as one from Seattle, shares the story with each of them, and everyone involved on both ends comes to believe it is a local problem here.

It is the single most annoying situation I have ever experienced in the voice business.”