Voice over IP

Lessons Learned

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Sept 2005

Agenda

VoIP Lessons Learned

- Trouble ticket analysis
- Case Study I: VoIP CTR analysis
- Case Study II: VoIP vs CBR CTR analysis
- Examples

VoIP Lessons Learned: Analysis of Customer Trouble Reports

Customer Trouble Report Analysis

- What is a Customer Trouble Report?
  - Any customer interaction in regard to service inconsistency or trouble

Impact of Customer Trouble Reports

- CTRs have a negative impact:
  - Low customer satisfaction: results in discontinuation of service
  - Increases costs: consumes resources to troubleshoot and often results in additional truck rolls
  - Reduced profitability: consumes resources that can otherwise be used to expand service to more customers
- Goal is to minimize CTRs and perform continual CTR analysis to identify major contributing factors and correct them.

How do you minimize CTRs?

Identifying the Major Contributors

- In order to minimize CTRs one must first:
  - Understand the major contributors to CTRs
  - Understand the root cause of the CTRs
  - Then implement corrective actions to eliminate the root cause and prevent it from returning
- Characteristics of CTRs may vary significantly between operators or even regions. May depend on:
  - Training and/or expertise of installers
  - Pre and post installation practices

You must understand all your problems before you can fix them!

Pareto Principle: 80/20 Rule

- Concept of disproportion holds true in many areas:
  - 80% of the wealth is owned by 20% of the people
  - 80% of the traffic goes through 20% of the streets
  - 80% of the problems are caused by 20% of the people
  - 80% of the work is done by 20% of the people
  - 80% of the CTR's are caused by 20% of the problems
- The exact proportion whether 20/80 or 10/90 is not significant. Understanding the disproportion is.

Key: expend effort on the "vital few" rather than the "trivial many"

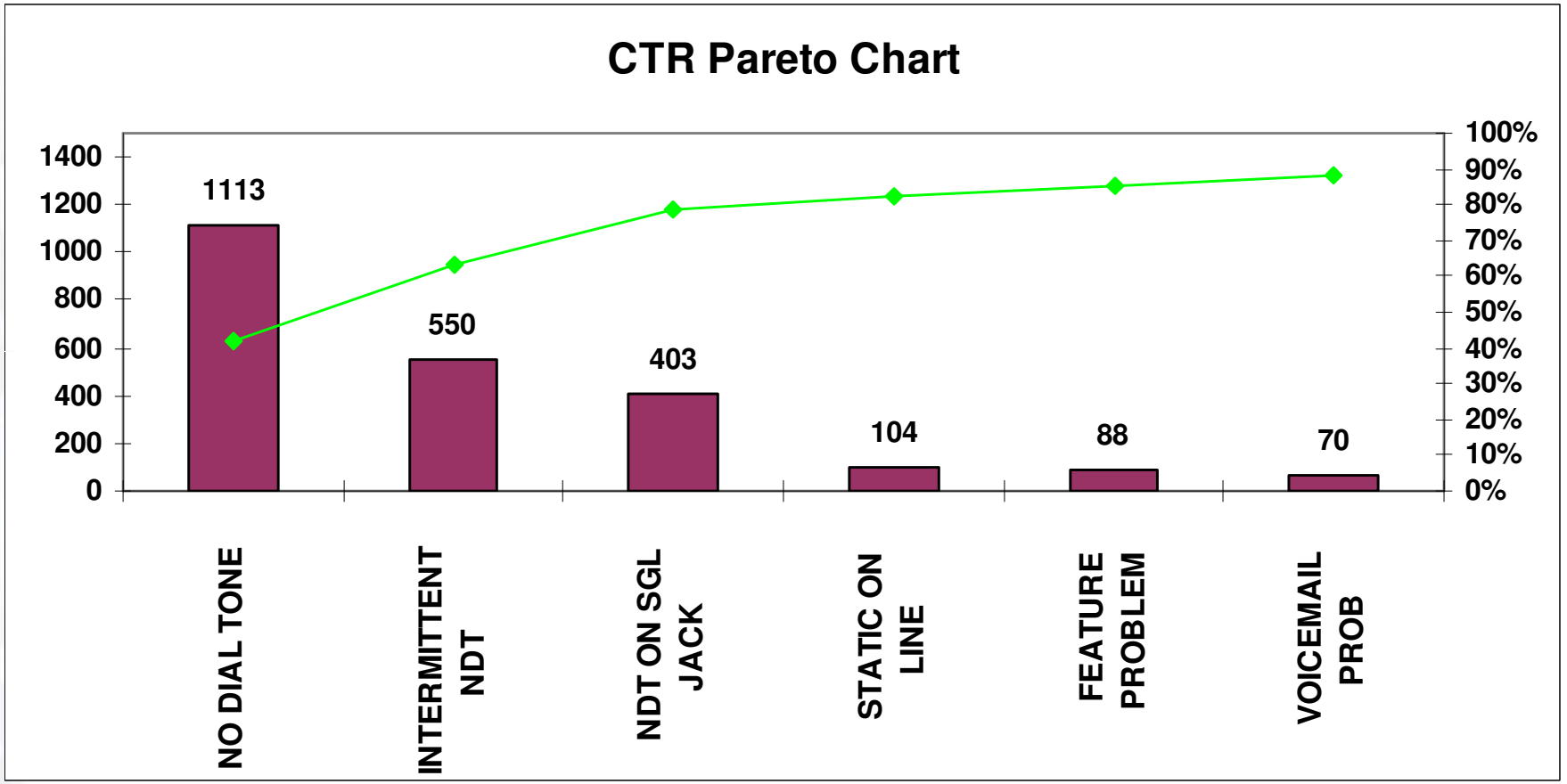
VoIP Lessons Learned:
Case Study I: VoIP CTR Analysis

Case Study I: VoIP CTR Analysis

- VoIP Market with 16,000 customers in service
- 2600 CTR's in a month: 16.2%

- Immediate Reaction:
  - CTR rate is much too high
  - Should be in the order of 3-5% per month (Benchmark)

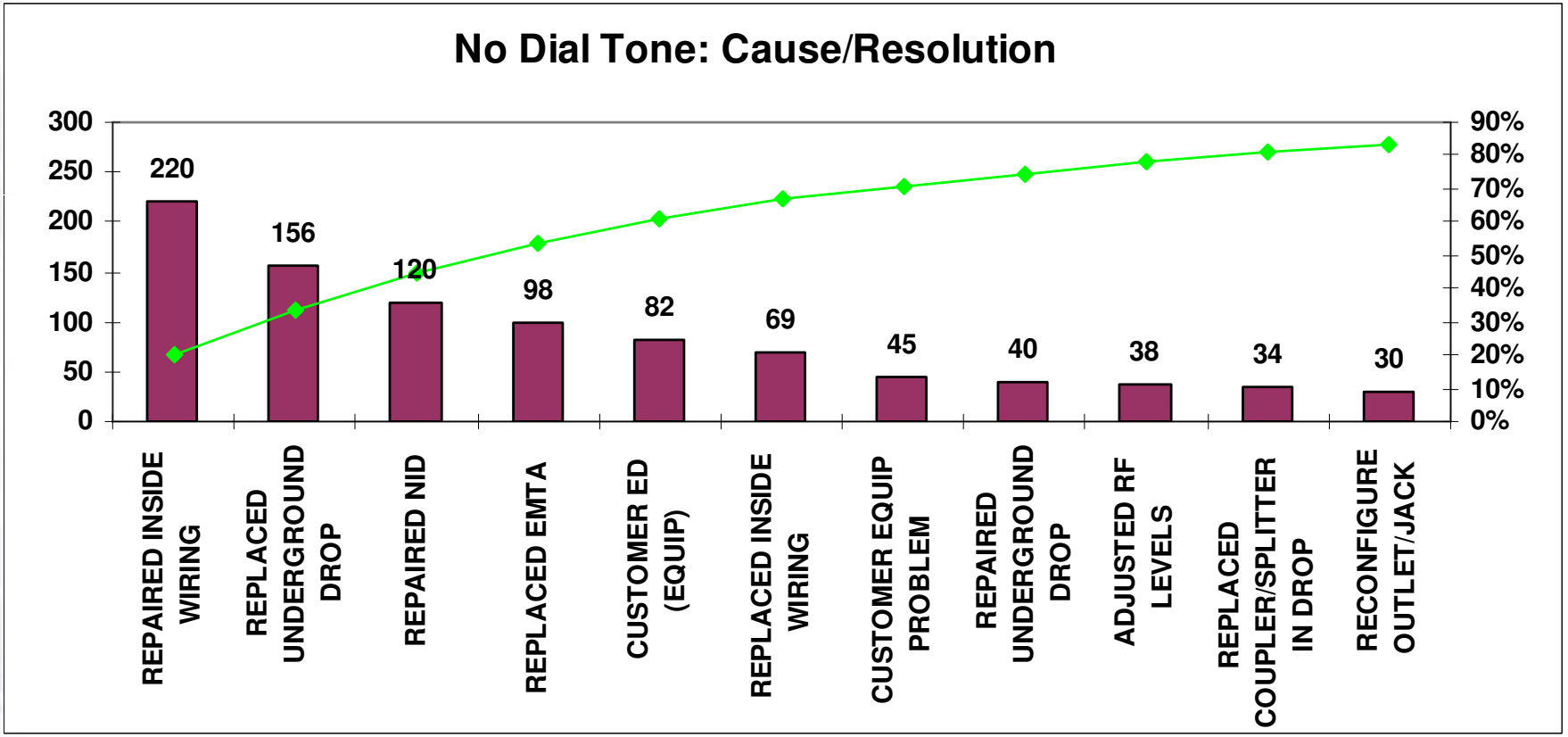
Case Study I: Overall VoIP CTR Pareto



3 CTR types account for 80% of all trouble tickets generated.

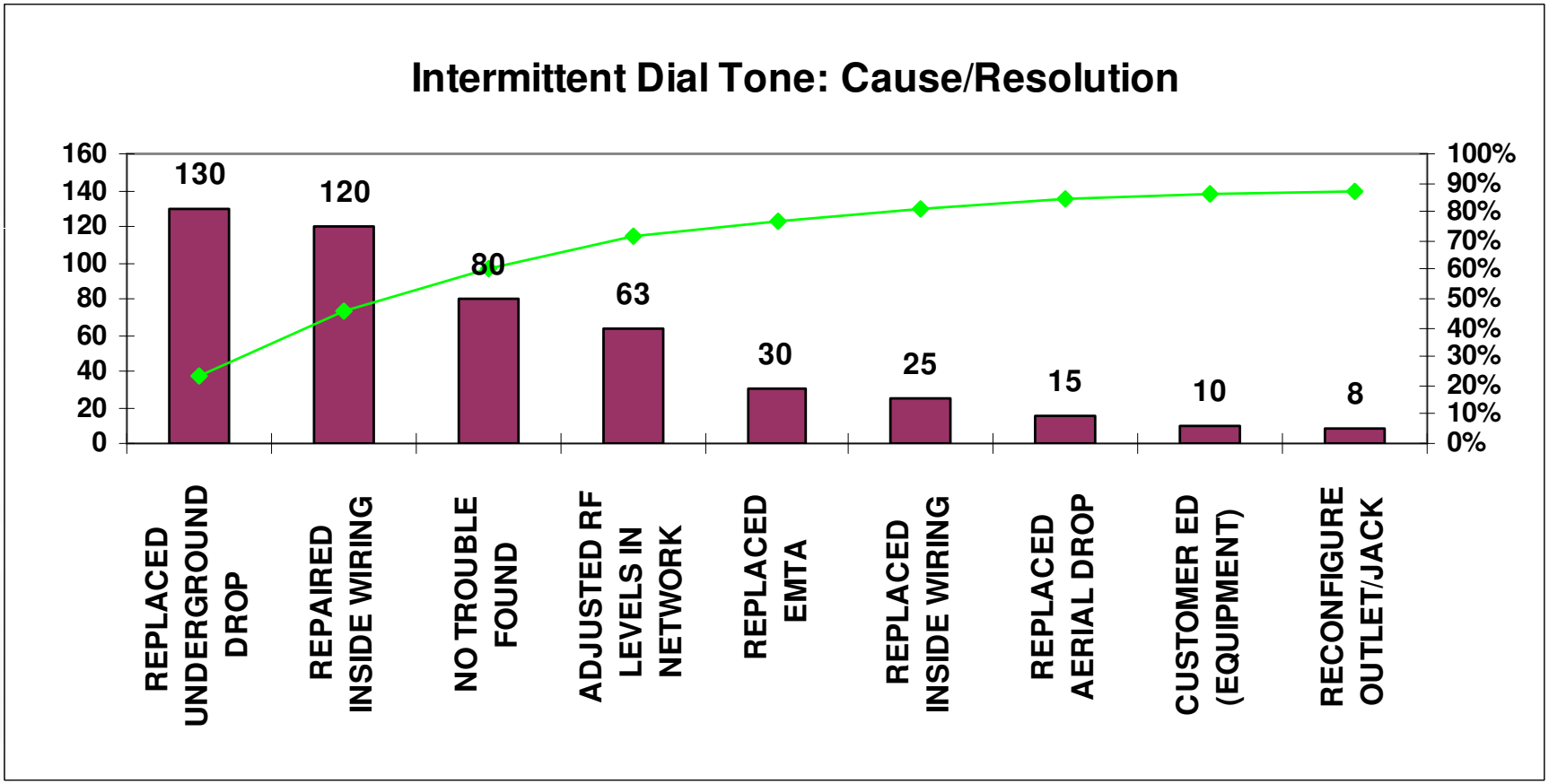
Case Study I: Cause/Resolution Pareto

Next Level Pareto Analysis: No Dial Tone Cause/Resolution



Case Study I: Cause/Resolution Pareto

Next Level Pareto Analysis: Intermittent No Dial Tone Cause/Resolution



Case Study I: VoIP CTR Summary

CTR Summary

CTR	QTY	%	Cumulative	Comments
NO DIAL TONE	1113	42%	42%	These 4 problems account for 80% of all CTR's. This is where most of the effort should be expended.
INTERMITTENT NDT	550	21%	63%	
NDT ON SGL JACK	403	15%	78%	
STATIC ON LINE	104	4%	82%	
FEATURE PROBLEM	88	3%	86%	These account for less than 20% all CTR's. Effort here should be secondary.
VOICEMAIL PROB	70	3%	88%	
GENERAL OUTAGE	66	3%	91%	
DROP DAMAGED/CUT	35	1%	92%	
CANT RCV CALLS	33	1%	93%	
NIU BOUNCING LOSS	22	1%	94%	

Case Study I : Cause/Resolution Summary

NDT Resolution Summary

NDT CAUSE/RESOLUTION	QTY	%	Cumul	Comments
REPAIRED INSIDE WIRING	220	20%	20%	80% of the NDT were resolved by addressing these issues
REPLACED UNDERGROUND DROP	156	14%	34%	
REPAIRED NID	120	11%	45%	
REPLACED EMTA	98	9%	53%	
CUSTOMER ED (EQUIP)	82	7%	61%	
REPLACED INSIDE WIRING	69	6%	67%	
CUSTOMER EQUIP PROBLEM	45	4%	71%	
REPAIRED UNDERGROUND DROP	40	4%	75%	
ADJUSTED RF LEVELS	38	3%	78%	
REPLACED COUPLER/SPLITTER	34	3%	81%	

Case Study I: Cause/Resolution Summary

I-NDT Resolution Summary

I-NDT CAUSE/RESOLUTION	QTY	%	Cumul	Comments
REPLACED UNDERGROUND DROP	130	24%	24%	80% of the Intermittent NDT were resolved by addressing these issues
REPAIRED INSIDE WIRING	120	22%	45%	
NO TROUBLE FOUND	80	15%	60%	
ADJUSTED RF LEVELS	63	11%	71%	
REPLACED EMTA	30	5%	77%	
REPLACED INSIDE WIRING	25	5%	81%	
REPLACED AERIAL DROP	15	3%	84%	These account for less than 20% of the Intermittent NDT issues. Effort here should be secondary.
CUSTOMER ED (EQUIP)	10	2%	86%	
RECONFIGURE OUTLET/JACK	8	1%	87%	
REPAIRED UNDERGROUND DROP	8	1%	89%	

Case Study I: Findings/Observations

Summary of Findings and Observations:

- Majority of CTRs can be avoided by improving installation practices:
  - Pre Installation inspection:
    - Check for proper RF levels.
    - Check for damage or condition of splitters and couplers in Coax Drop
    - Check inside wiring for continuity at all jacks
    - Check for shorts or foreign voltages (AC or DC)
    - Check NID for proper wiring and ensure LEC connection is physically disconnected
  - Post Installation validation
    - Check for dial tone at all jacks
    - Make test calls on all customer premise equipment
    - Educate customer on equipment and features

Comprehensive Methods & Procedures and thorough training of installation personnel are key factors for success in reducing CTRs

Case Study I: Findings/Observations

- Customer Education
  - Equipment
    - Customers need to be educated to not unplug the EMTA or connect to a switched outlet otherwise phone service can be disrupted
    - Customers need to understand that EMTA consumes very little standby power - similar to a night light.
    - Educate customer to not place EMTA where liquids may be spilled into it.
  - Features
    - Educate customer on how to use call features, provide reference literature/handbook
    - Educate customer that certain features require compatible CPE: e.g. Call Waiting Deluxe, Caller ID, Message Waiting Indicator.

Case Study I: Findings/Observations

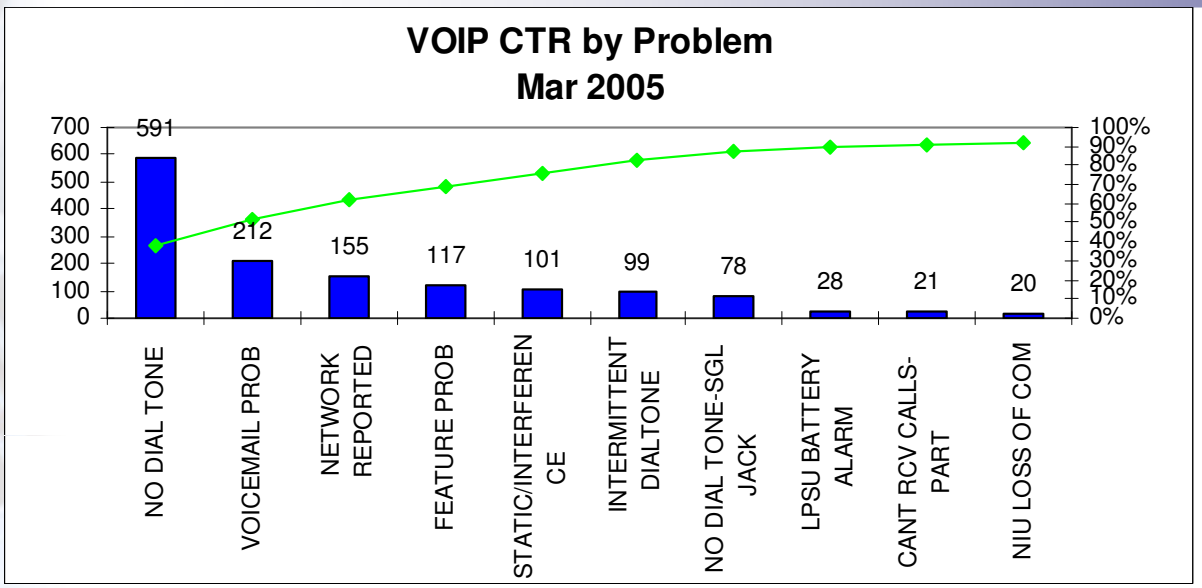
- No Trouble Found
  - NTF's are a main contributor to repeat CTR
  - NTF's are typically attributed to marginal RF levels. Temperature changes cause levels to shift and may cause EMTA to drop in and out of service.
- EMTA replaced
  - EMTA MTBF results in less than 1% annualized failure rate
  - Majority of these units were falsely convicted and were "No Fault Found"
  - Marginal RF levels were beyond the limits of the DOCSIS RF spec
    - Some installers were swapping units until one worked rather than resolving the level problem
    - Also resulted in repeat CTRs with No Trouble Found

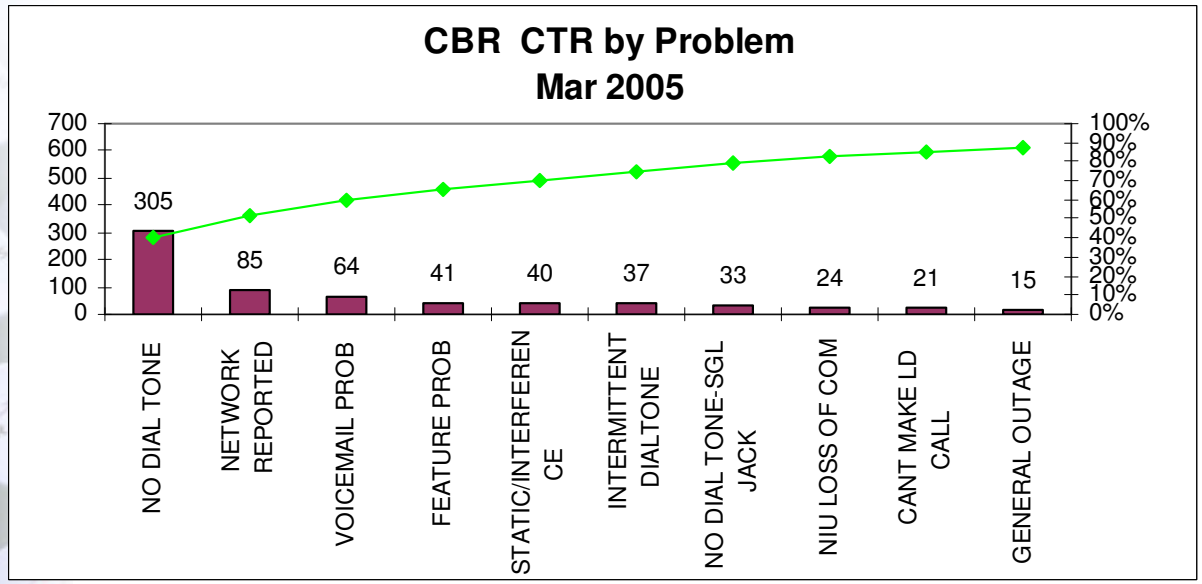
VoIP Lessons Learned:
Case Study II: VoIP vs CBR

Case Study II: VoIP vs CBR

- This study performed on a site with a mature CBR deployment and a relatively new VoIP deployment
- Purpose:
  - To look for similarities between causes of VoIP CTRs and CBR CTR's
  - Close similarities would indicate that experience gained in CBR deployments may be exploited to reduce CTRs in VoIP deployments

CTR by Reported Problem – VoIP vs CBR





CTR characteristics for VoIP and CBR are very similar:

- **VoIP: 40% NDT**
- **CBR: 38% NDT**
- **VoIP: 90% of all CTR's attributed to 10 problem codes**
- **CBR: 87% of all CTR's attributed to 10 problem codes**

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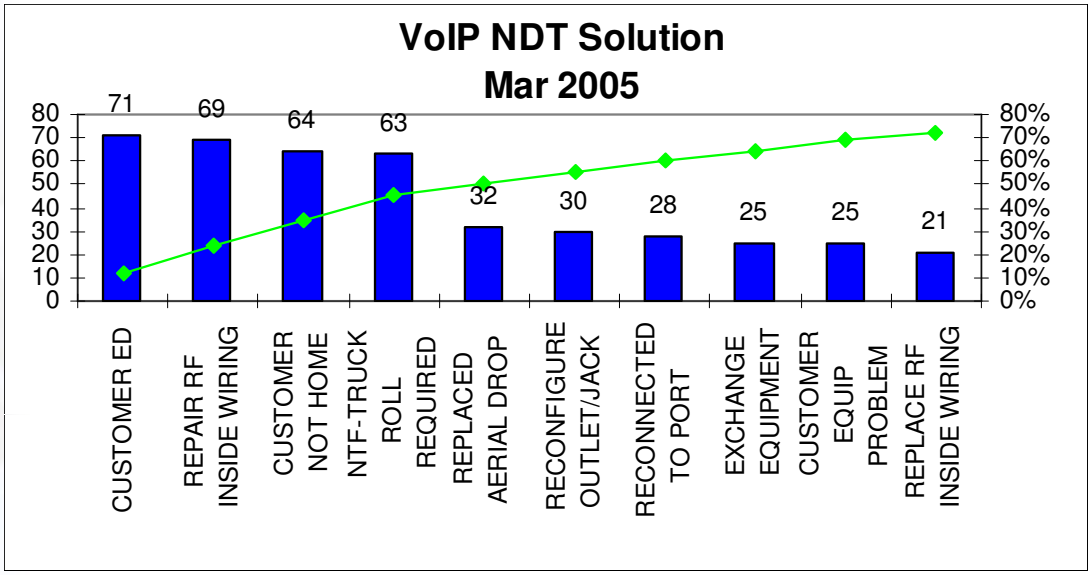
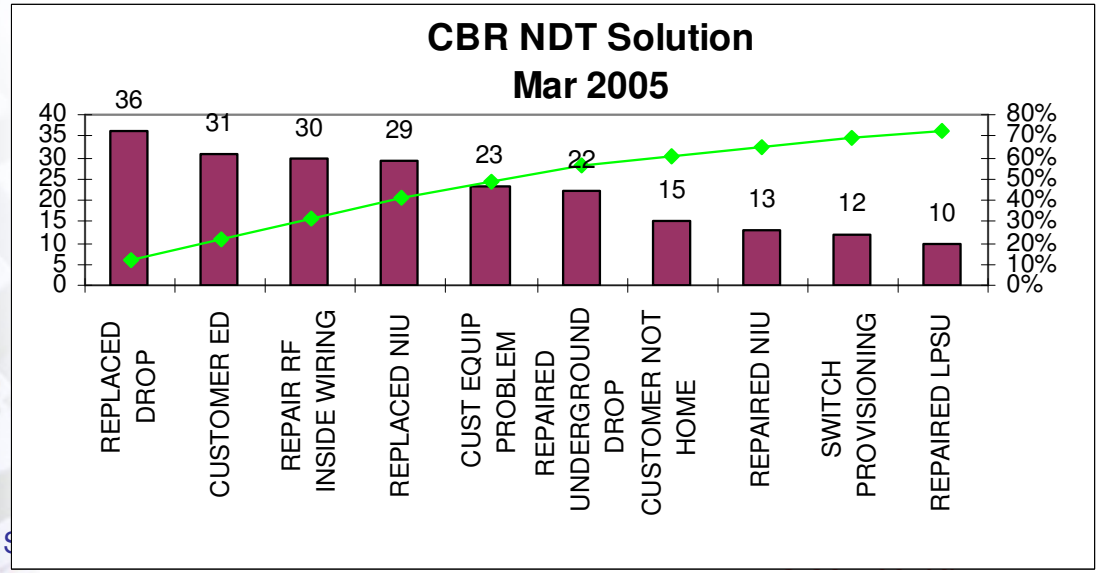
NDT Solutions – VoIP vs CBR





NDT Solution profile for VoIP and CBR are very similar:

- **VoIP: 72% of NDT CTR's resolved by 10 solutions**
- **CBR: 72% of NDT CTR's resolved by 10 solutions**
- **Educate customer on equipment and repair inside wiring are in the top 3 for CBR and VoIP**

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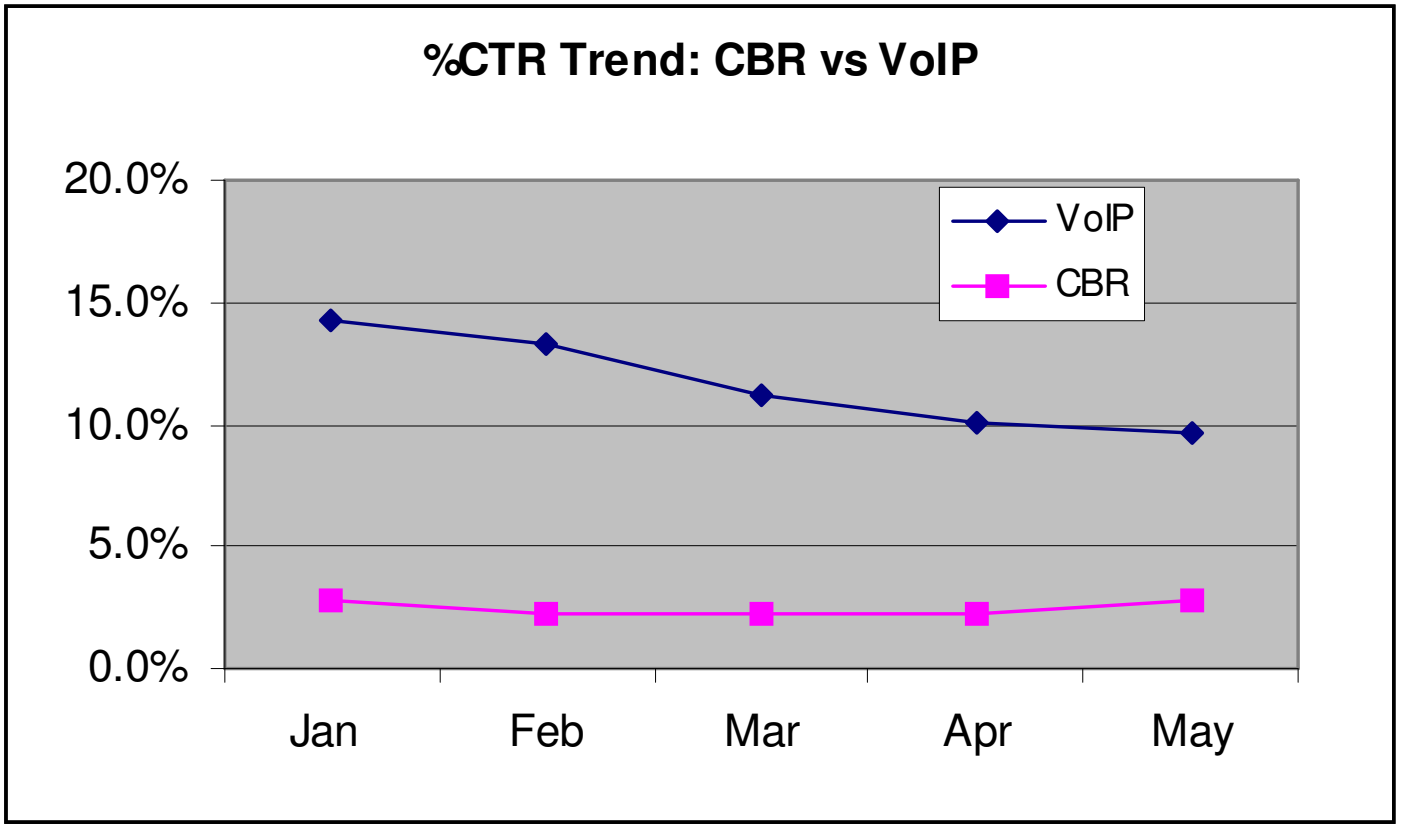
%CTR per Month – VoIP vs CBR



VOIP CTR rate much higher than CBR but exhibiting a good downward trend

Case Study II: Findings/Observations

- NDT is the number one reported issue in both VoIP and CBR deployment – almost identical percentage
- Causes of NDT are similar in both technologies
- High runner NDT causes are:
  - Inside wiring
  - Customer education
- Experience gained in CBR deployments are applicable to VoIP deployments

Overall Case Study Summary

- CTRs for VoIP are very similar to early CBR deployments
- CTRs may differ greatly between MSO's or Markets
  - May be dependent on service offering, and training of workforce.
  - Important to understand all the problems before they can be addressed effectively.
- CTR analysis using Pareto analysis is a very effective means to identify the major CTR contributors and create corrective action plans.

Examples

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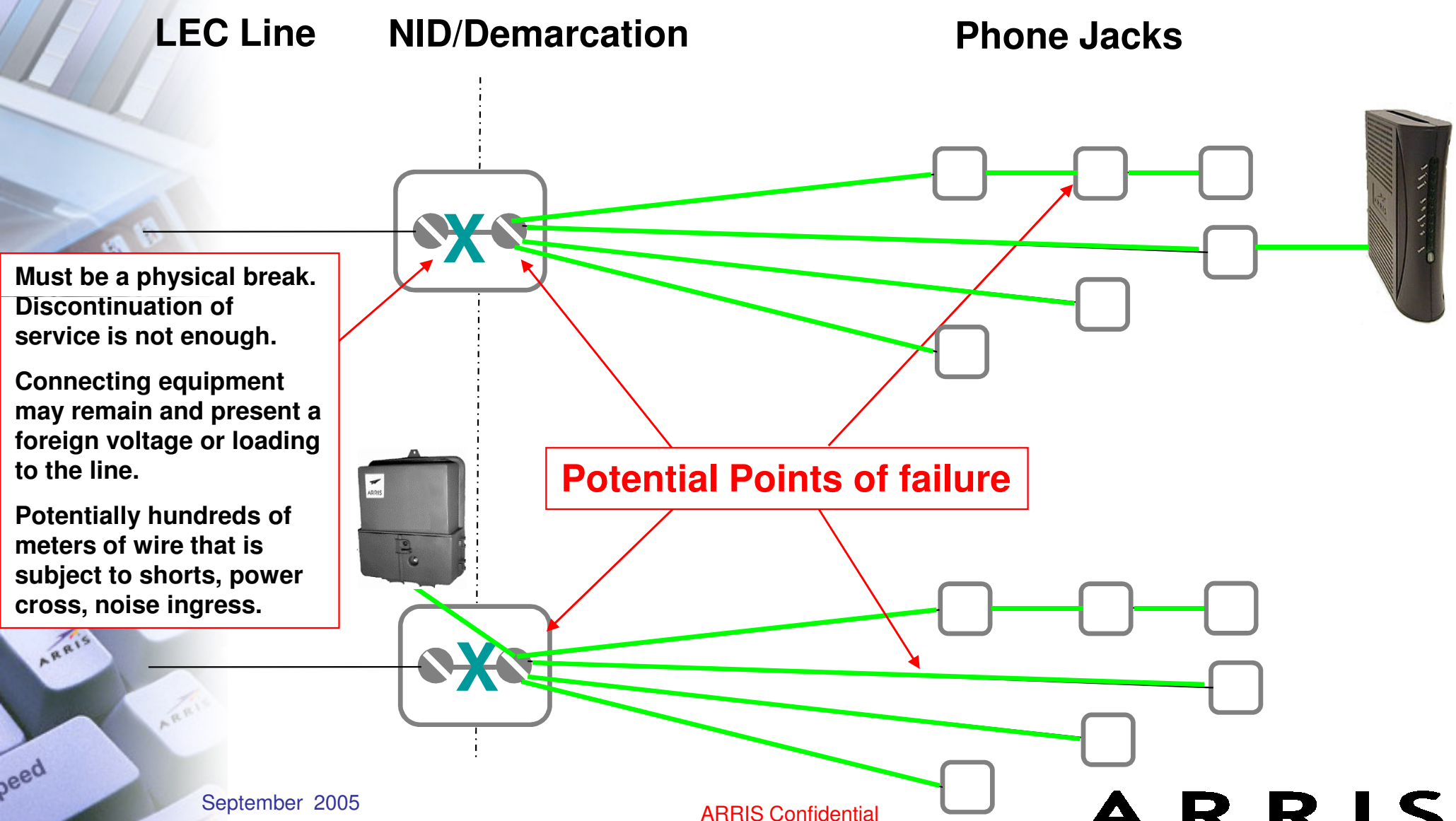
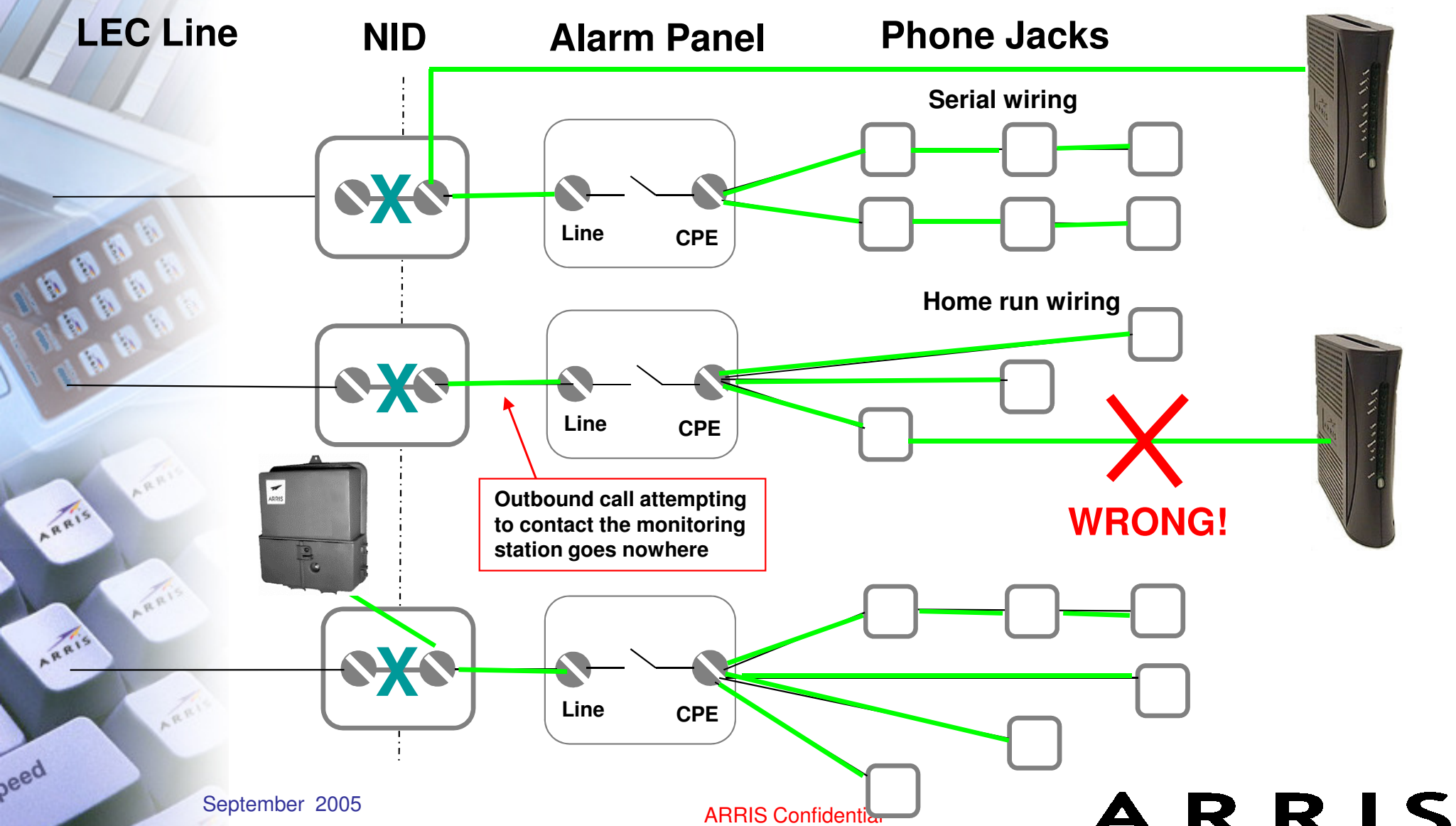
Typical Inside Wiring Faults



Wiring Faults with Security Systems



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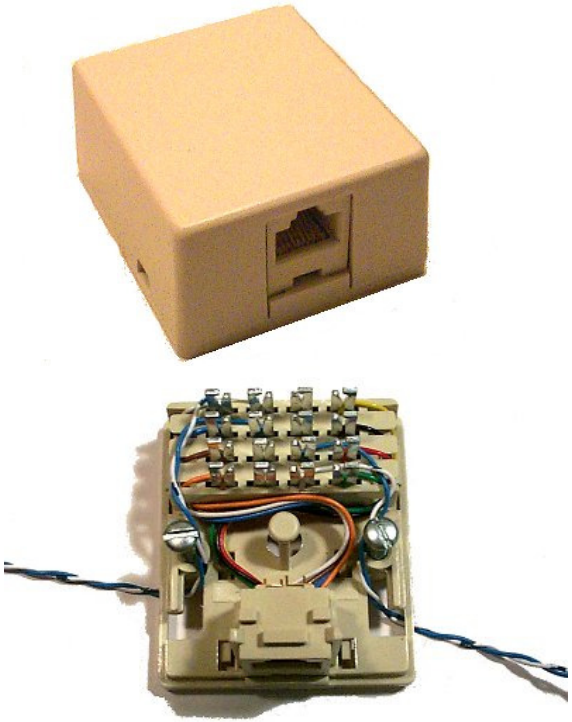
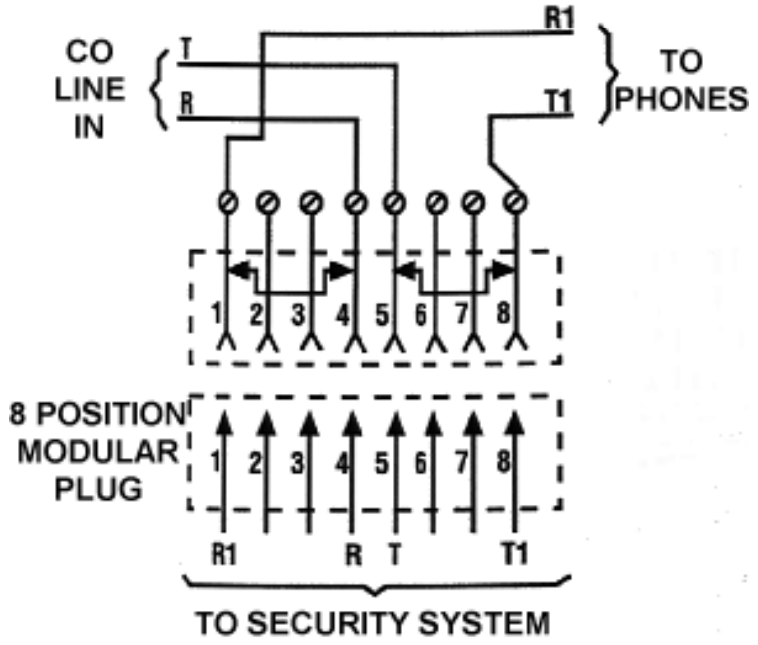
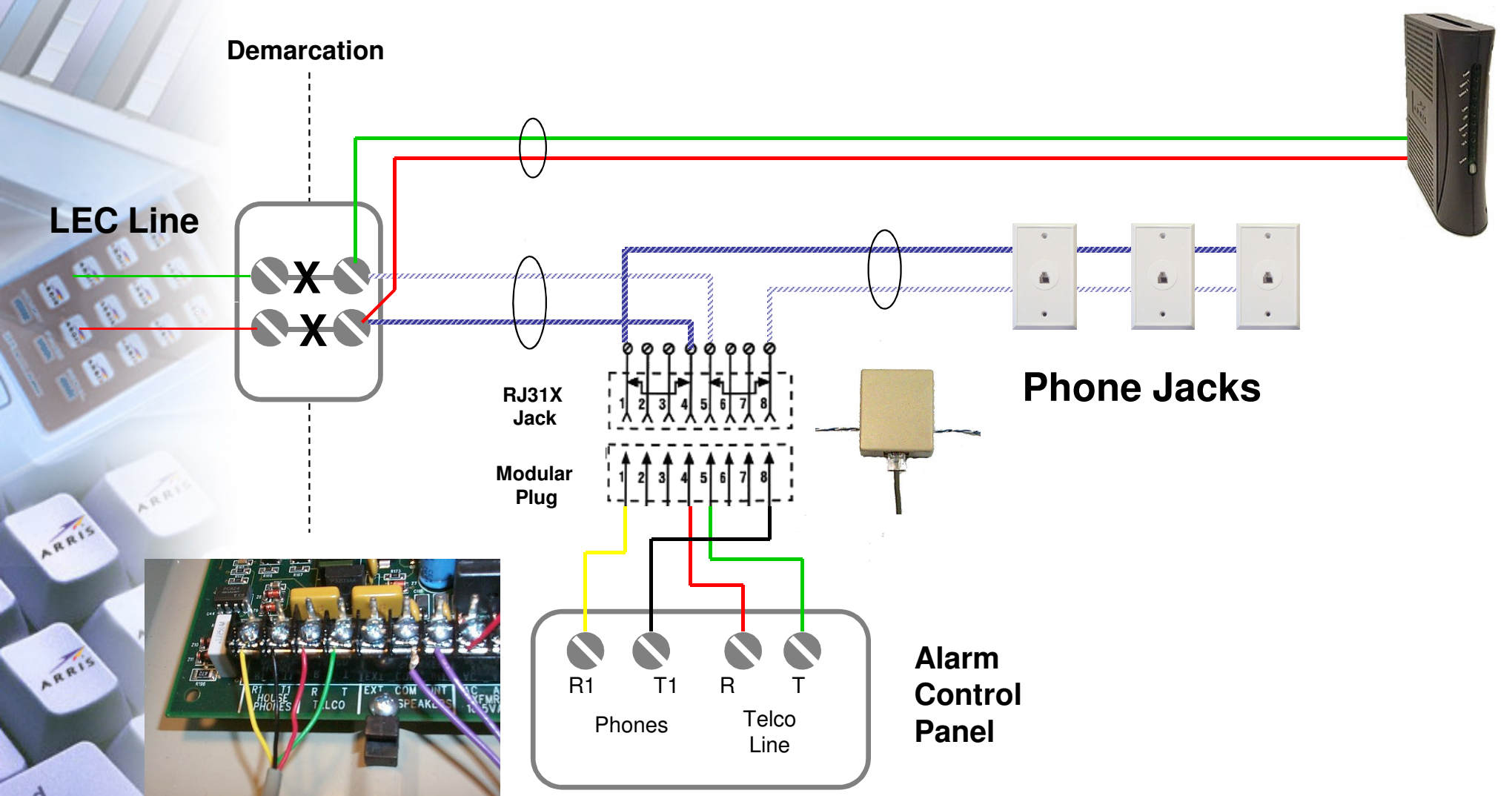
RJ31X Plug for Security Systems

- Used to connect security system control panel to home telephone wiring.
- Ensures control panel can disconnect phone users and has priority to “seize” the line to call the alarm monitoring station.





Wiring a Security System with RJ31X



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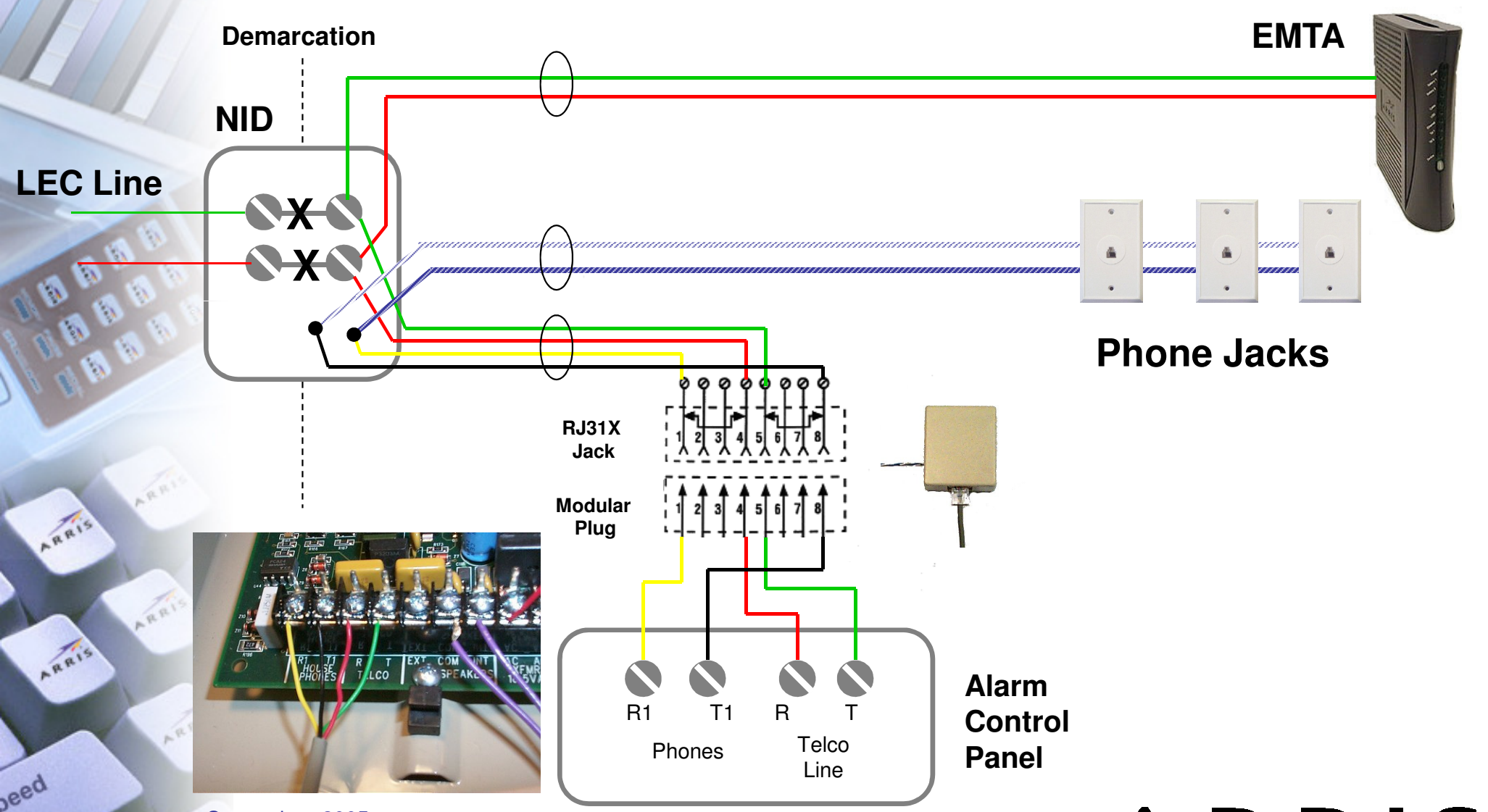

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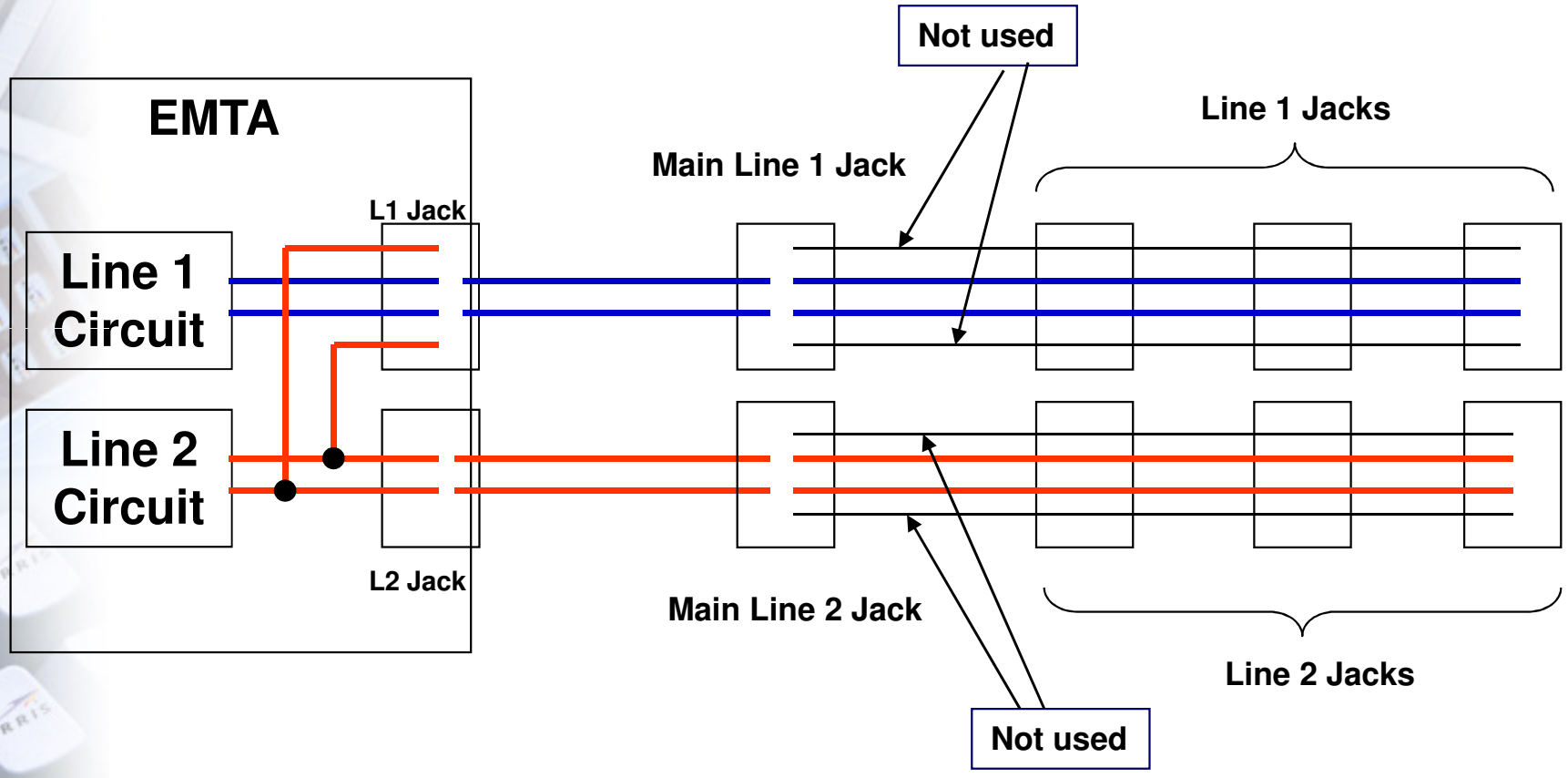
Customer Education

- Example:
  - Customer complains of “loud noises” when another call is coming in. Says it did not happen on their LEC line.
  - MSO CSR explains that it is normal to hear a tone on the line with Call Waiting and 2 tones with Call Waiting Deluxe.
  - Customer claims there is also a loud static after the 2 tones.
  - Further investigation reveals that the phone is an older model that supports Call Waiting Deluxe but does not mute the handset during the data transmission. Behavior identical on VoIP or LEC line.
  - Customer still adamant that this did not happen when they were on a LEC line.
  - Further investigation reveals the customer did not have Call Waiting or Call Waiting Deluxe with the LEC

MSO that provide value added call features at no additional charge need to be prepared to educate customer on features usage and outdated CPE

EMTA Connection to Inside Wiring



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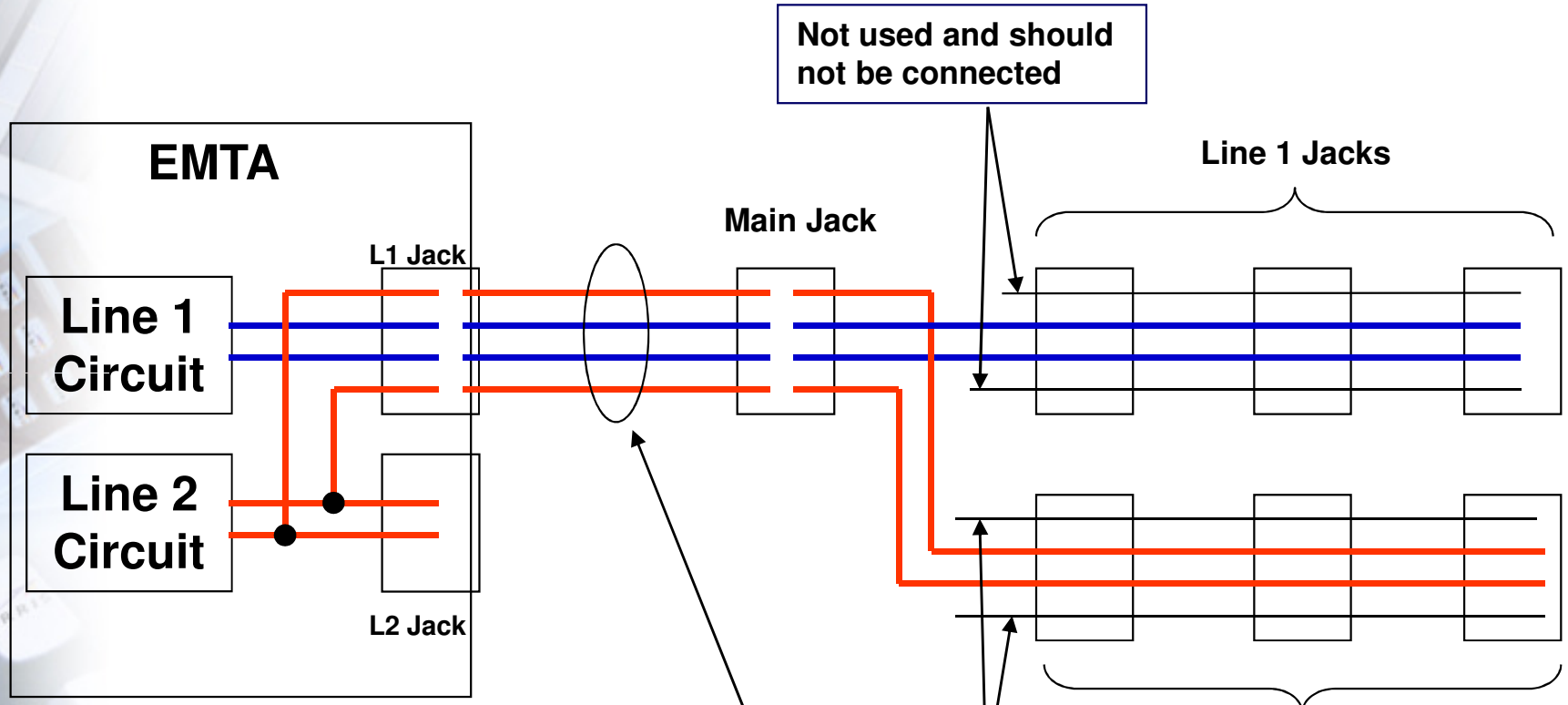
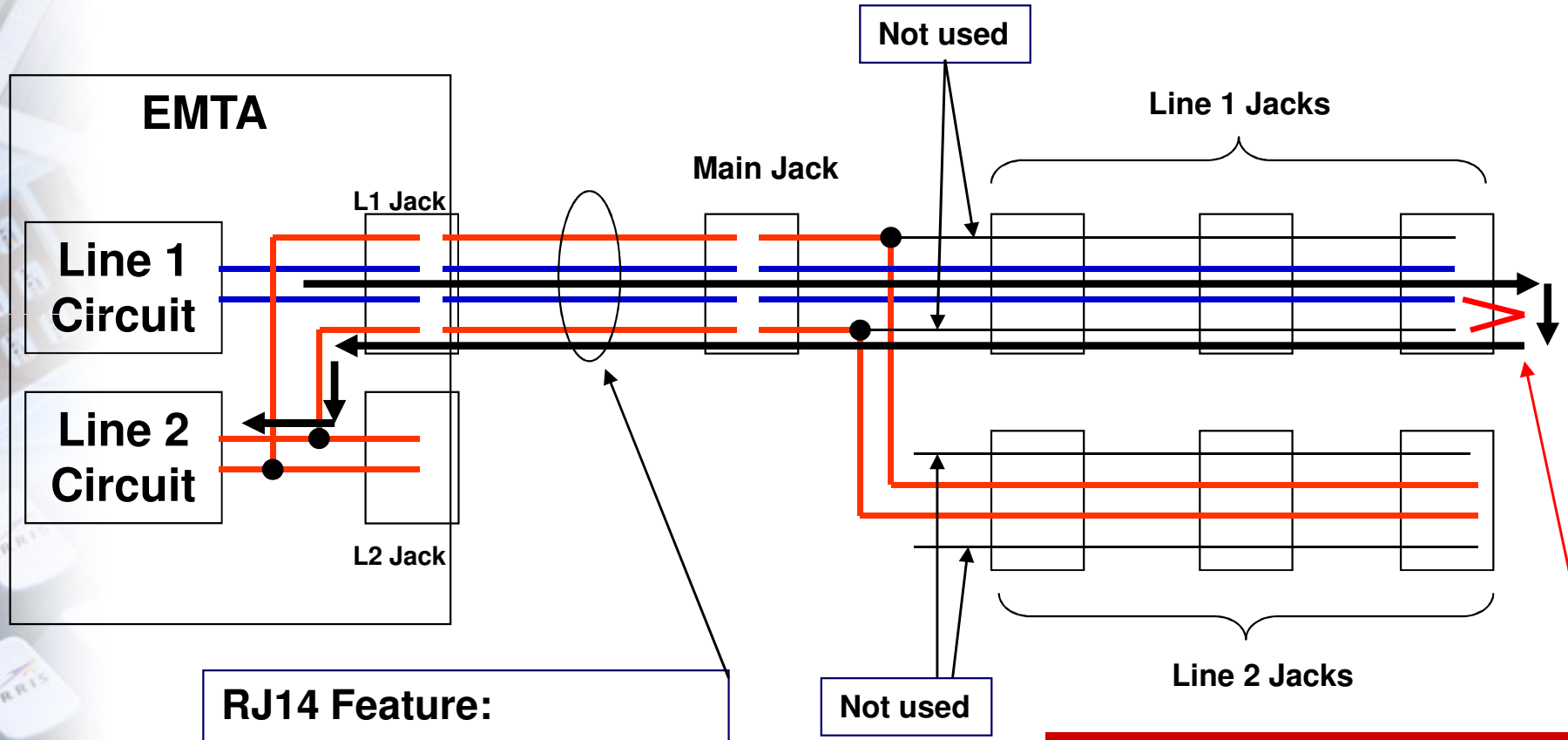


RJ14 Feature:

Facilitates distribution of 2 lines with a single 4 conductor phone cord

EMTA Connection to Inside Wiring



RJ14 Feature:

Facilitates distribution of 2 lines with a single 4 conductor phone cord

Short Circuit caused by wiring fault or CPE causes Line 1 to be back driven into Line 2