

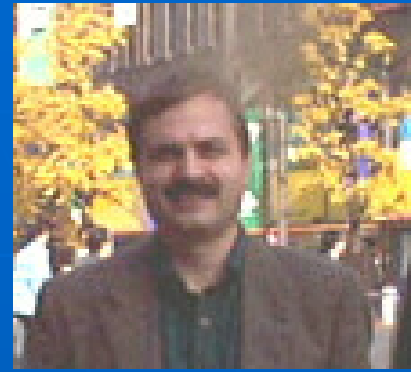
Upstream Testing and Monitoring For VoIP



Disclaimer

- Companies and products mentioned in this seminar are trademarks of their respective companies.
- Rick Jaworski only asserts rights to intellectual property owned by him.
- Rick always suggests you question vendors regarding points made in this seminar.

About Rick Jaworski



- Started in the cable industry in 1980 in design engineering.
- Two patents pending on upstream testing.
- Expert in cable testing, worked with or for Tektronix, Wavetek (Acterna), Avantron, Hukk and Sunrise Telecom.
- Currently working on other inventions.
- Developed the concept of the Hukk CM1000 cable modem tester which other instruments by Acterna and Trilithic have been patterned on.
- Currently an independent inventor that develops new technologies in cable and other industries.



VoIP The Next Killer App

- Voice over IP (VoIP) appears to be poised to change the telephone industry in a way not seen since the beginning of telephony.
- VoIP transmission over the Internet provides an extremely low cost telephony transport and allows access to the coveted "last mile" to the subscriber.
- Vonage has proven that VoIP can be a practical service.
- Cable companies are in a unique position to provide low cost VoIP service because of their installed base of Cable Modems.

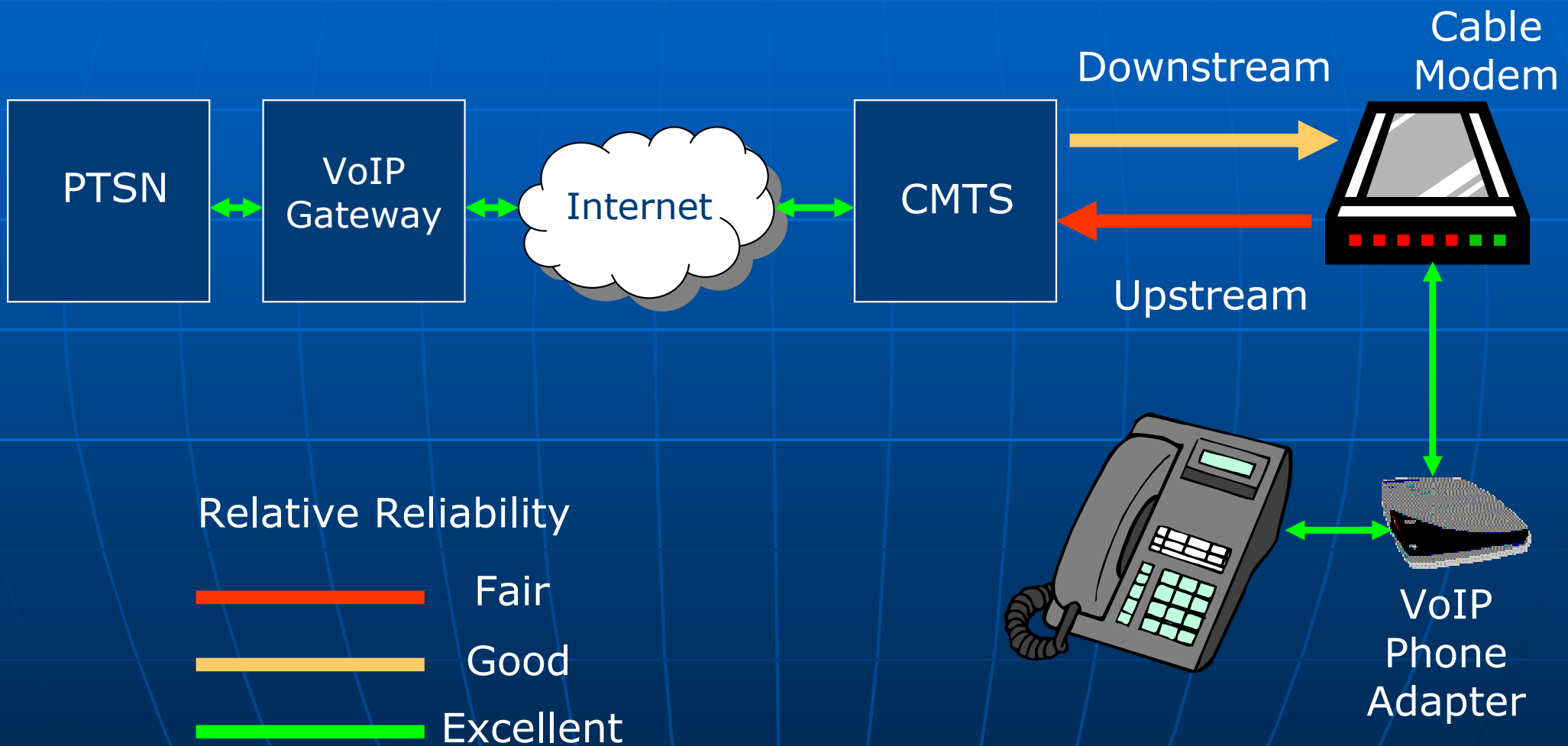


VoIP The Next Killer App

- DSL is at a disadvantage due to the fact that the twisted pair is still required to provide high speed service.
- Cable is in a good position to compete with ground breaking companies like Vonage because of their ability to provide local service and support.
- Many subscribers will find installing VoIP too complicated and this gives cable an advantage because of local support.



Upstream Path the Weakest Link in the VoIP System



Upstream Performance Critical to VoIP Performance

- Ingress on the return path can cause dropped packets on the upstream.
- Subscribers don't always notice lost packets as much when web surfing.
- Packets dropped on VoIP traffic can cause call break up and if severe enough dropped calls.
- VoIP traffic places a more stringent requirement on the upstream, even if the cable system isn't providing the VoIP service.



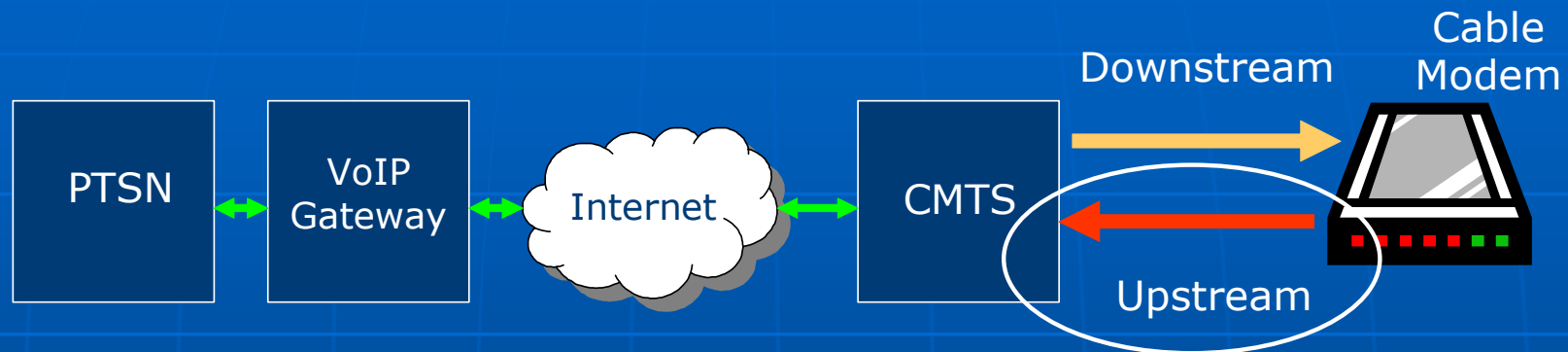
People are used to occasional slow surf



People are NOT used to call breakup and dropped calls at home



Testing and Monitoring Critical to Maintaining Upstream Performance



Continuous Monitoring,
Testing and Maintenance

- The only way to ensure a high quality upstream is to continually test and monitor the return path for ingress.
- Ingress on the return path needs to be identified quickly, ideally before it affects service, and the ingress point(s) repaired.

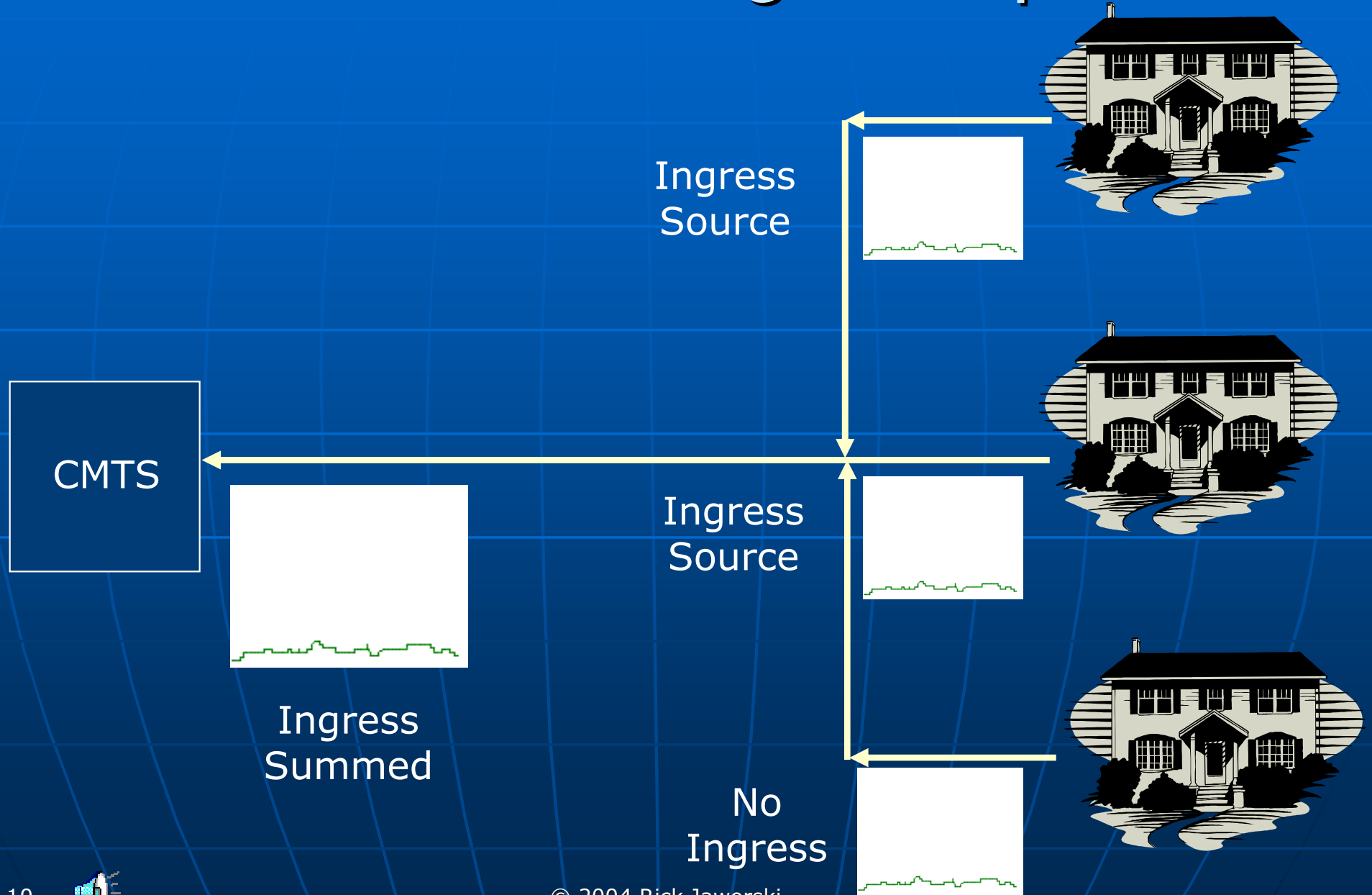


Testing and Monitoring Critical to Maintaining Upstream Performance

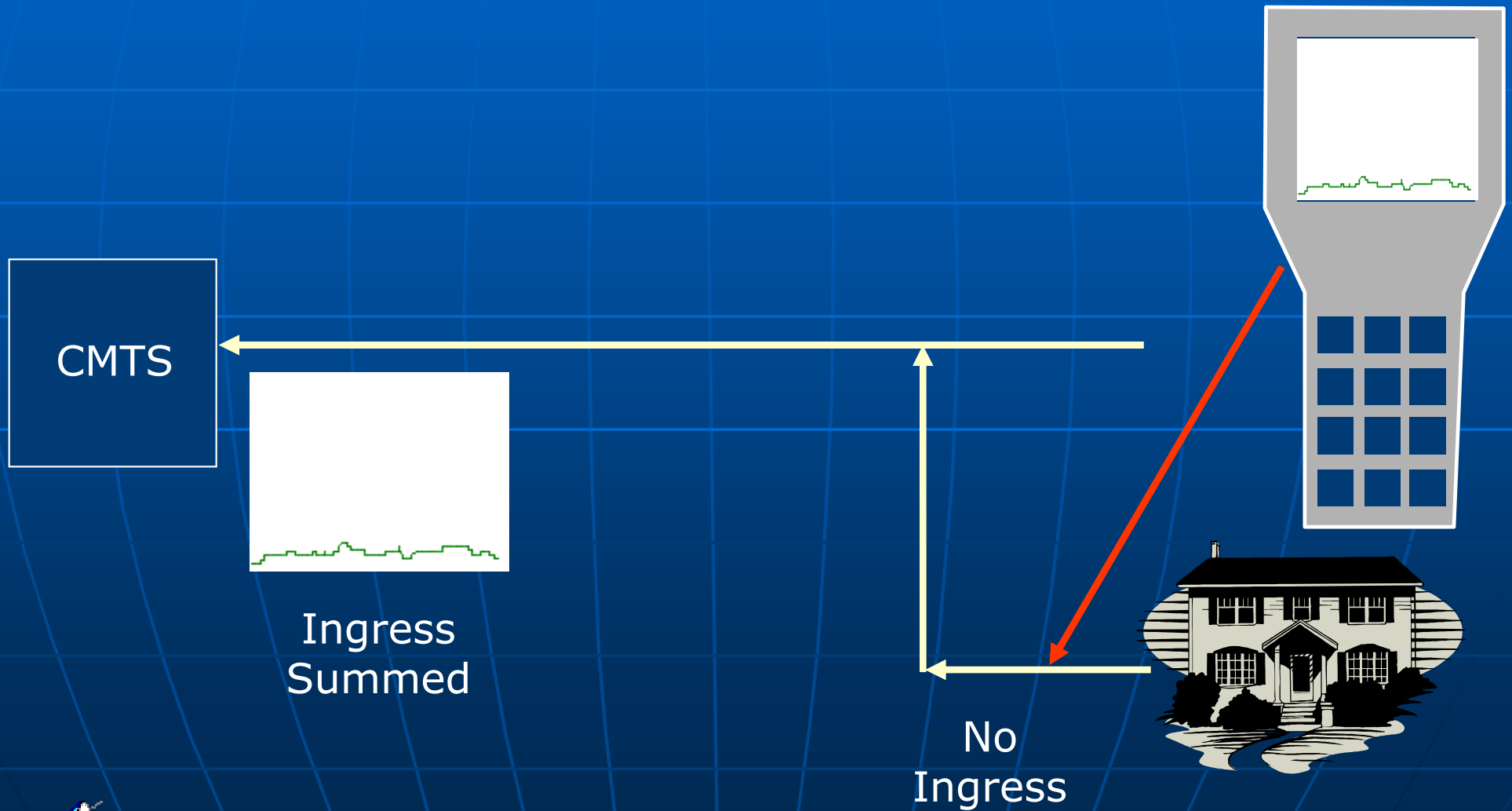
- Testing by field techs and continuous monitoring will identify problems and have them repaired before subscribers notice a degradation in service.
- Continuous monitoring and testing will insure a high quality return path and therefore good quality VoIP service.
- Test and monitoring equipment needs to be able to detect all forms of ingress including fast transient ingress.



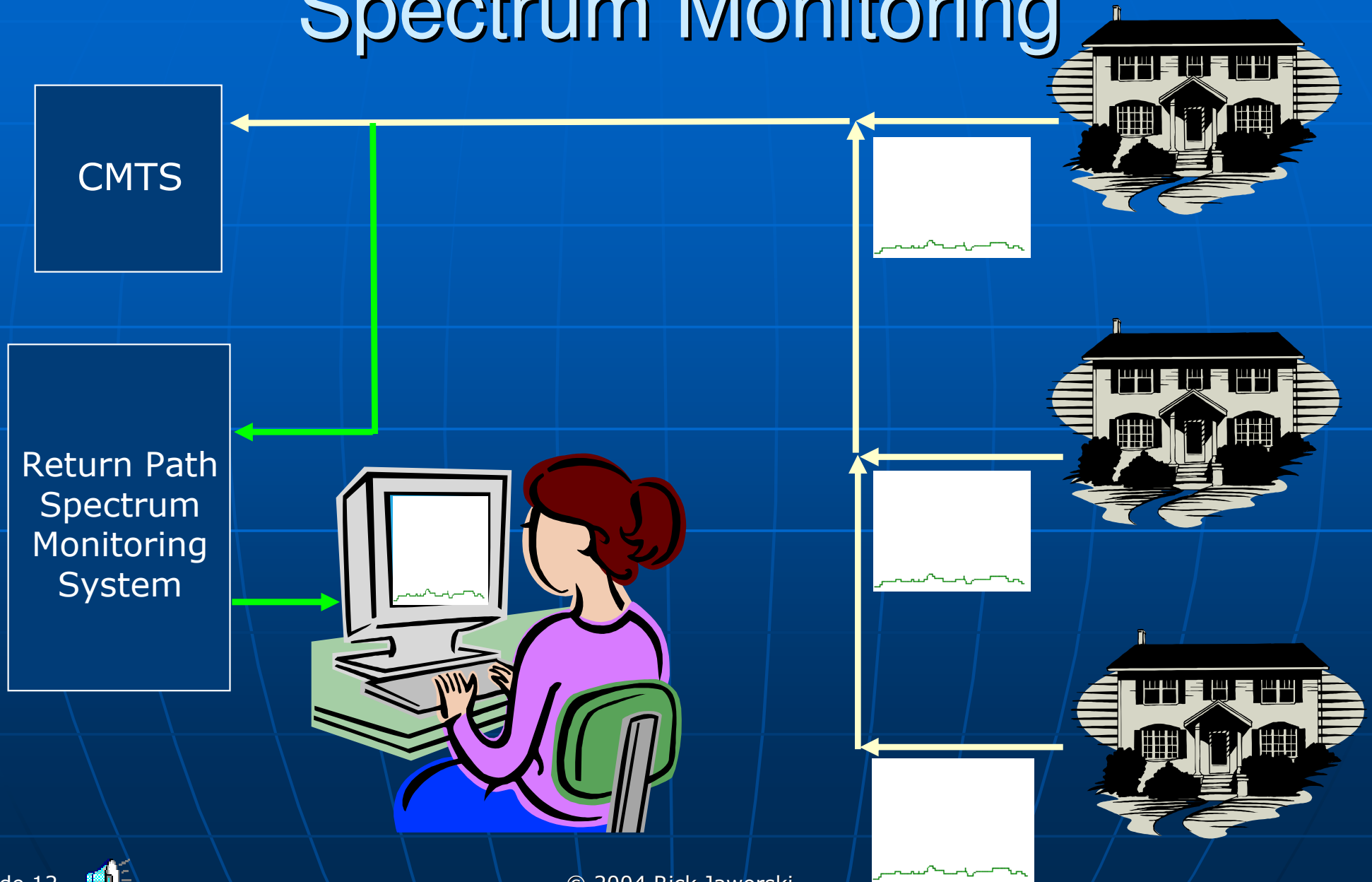
Difficulties in Testing the Upstream



Difficulties in Testing the Upstream



Return Path Monitoring Using Spectrum Monitoring



How Spectrum Monitoring Equipment Can Miss Fast Transient Ingress

Actual Transient Ingress



Slow Motion Example

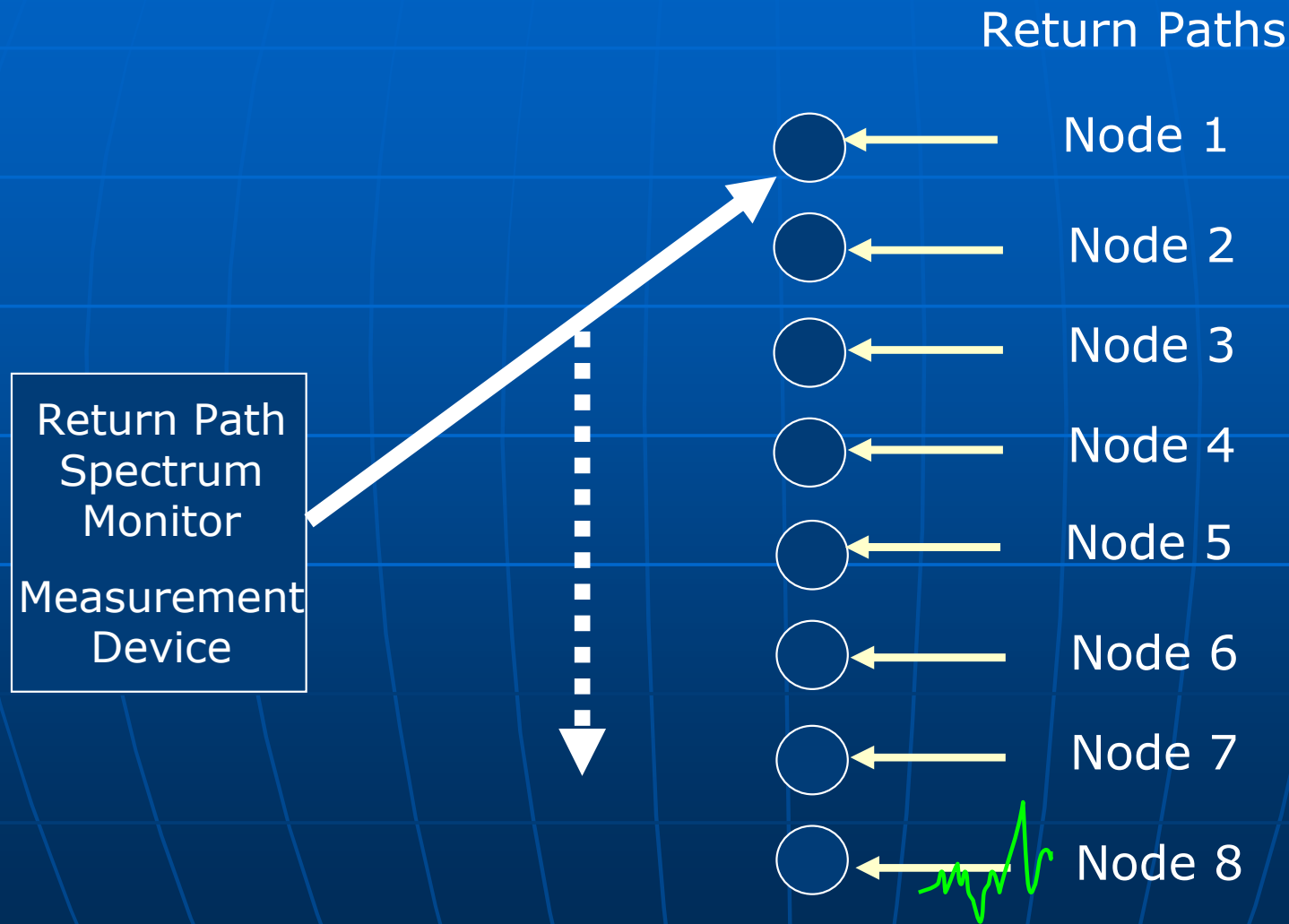
Display on Scanning Spectrum Analyzer/Return Path Monitor



- Most spectrum analyzers and return path monitors scan the frequency band.
- Only one frequency is measured at any given instant
- If fast transients happen at other times they are missed



How Spectrum Monitoring Equipment Can Miss Fast Transient Ingress



Monitoring the Upstream Spectrum

- Most return path monitoring systems such as those manufactured by Acterna and Sunrise Telecom use scanning spectrum analyzers.
- This scanning can miss fast transient ingress that will still cause lost packets on the upstream path.
- Often lost packets can occur even when monitoring systems are not showing any problems, due to scanning.

**Fast
Transient
Ingress**



Slow Motion Example

**Scanning
Return Path
Monitor
Indication**



Call Breakup or
Dropped Call

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Testing the Upstream for Lost Packets

- Clearly there needs to be a better way to find return path problems.
- If the test indicates lost packets, you are likely having some service impairment.
- Much more sensitive to fast transients ingress.

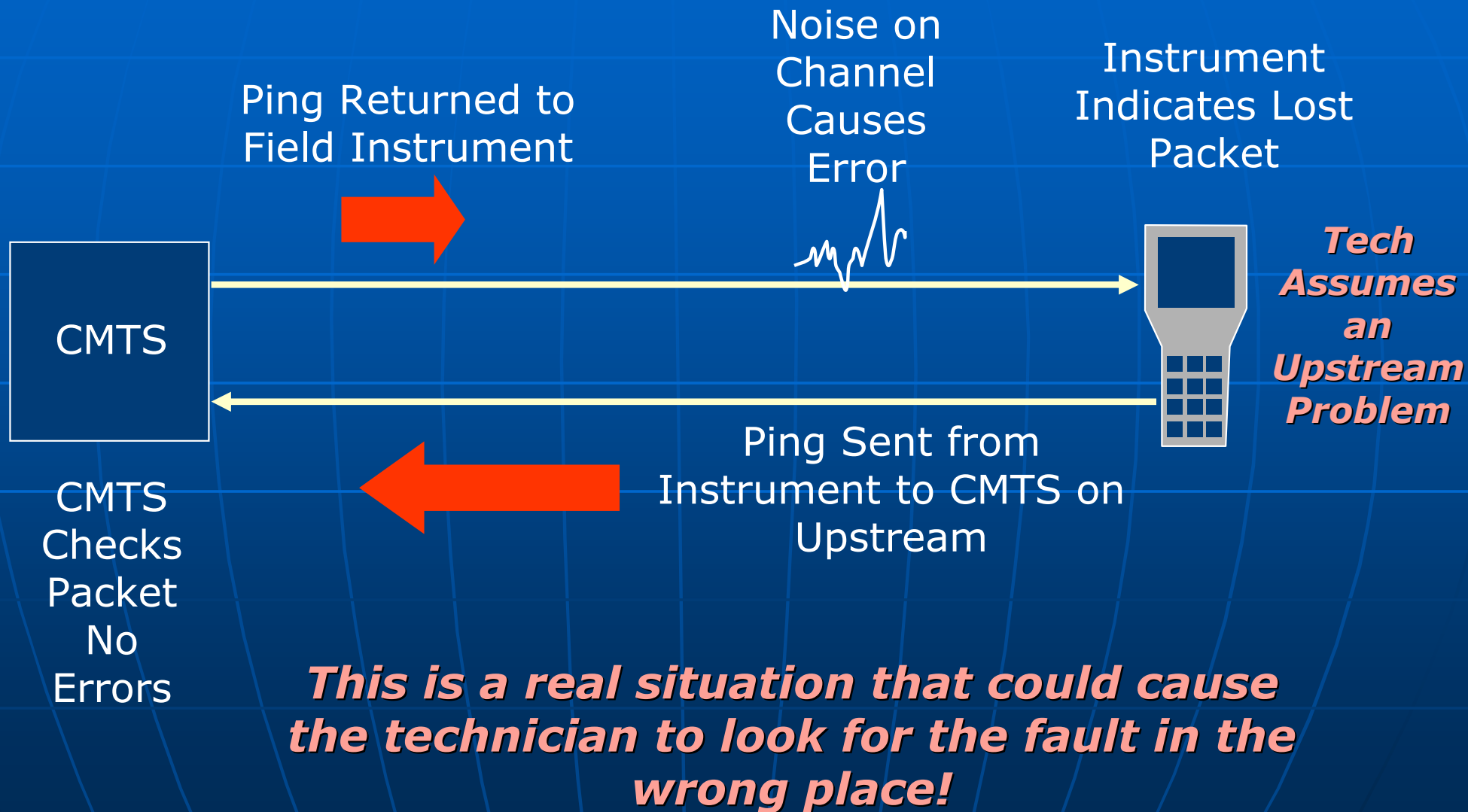


Pinging the CMTS Using the Cable Modem Channel

- Trilithic has suggested that a simple way to test the upstream is to simply ping the CMTS.
- The argument for this method is that most errors are caused in the upstream not the downstream.
- The problem with this method is if there are errors on the downstream such as those that would cause error severely errored seconds, then techs may look for problems in the wrong place.
- **Errors DO happen on the downstream!!**



The Problem With Pinging the CMTS to Test the Upstream



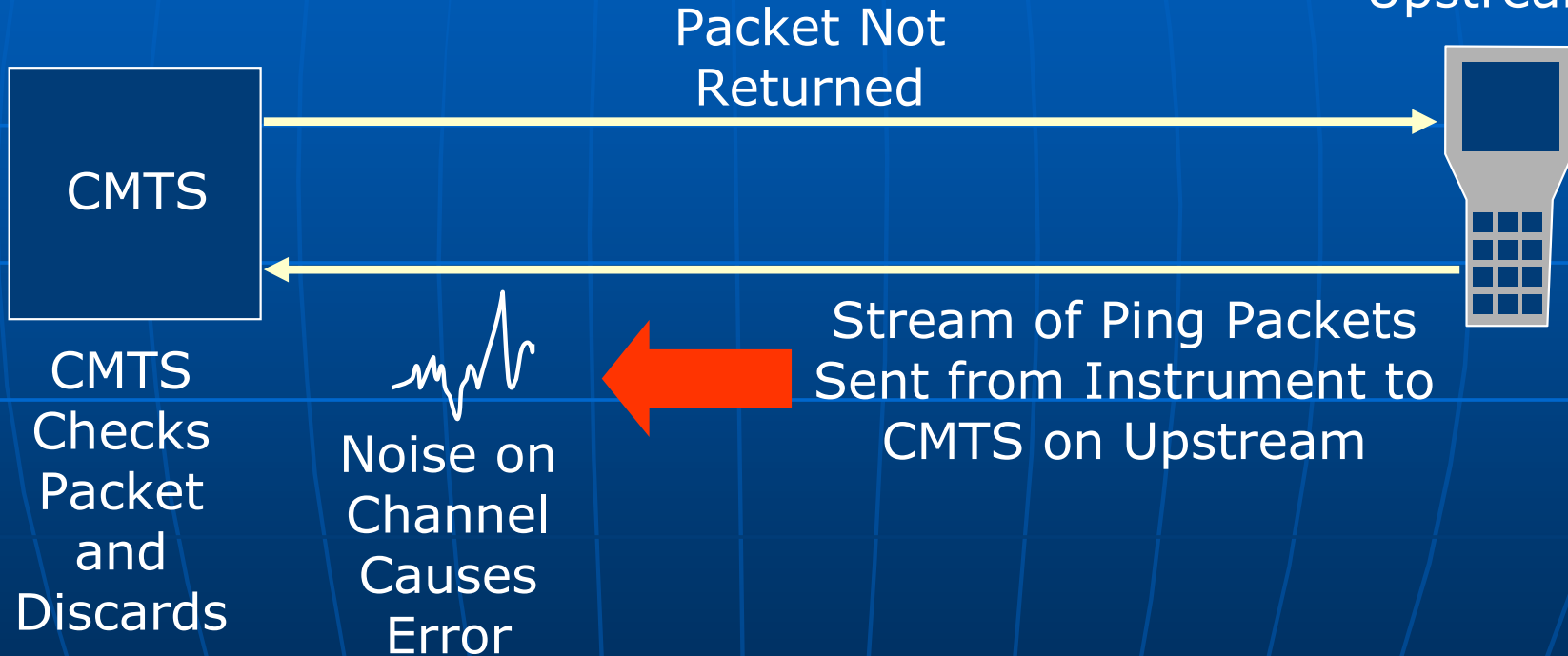
Isolating Lost Packets to the Upstream and Downstream

- There are two methods currently in use to enhance the ping measurement to only include upstream lost packets.
- These two methods eliminate the possibility of a ping falsely identifying problems in the upstream when it is a downstream problem.
- Sunrise Telecom and Acterna cable modem test products currently display lost packets isolated to the upstream path and eliminate any downstream lost packets from the measurement results.

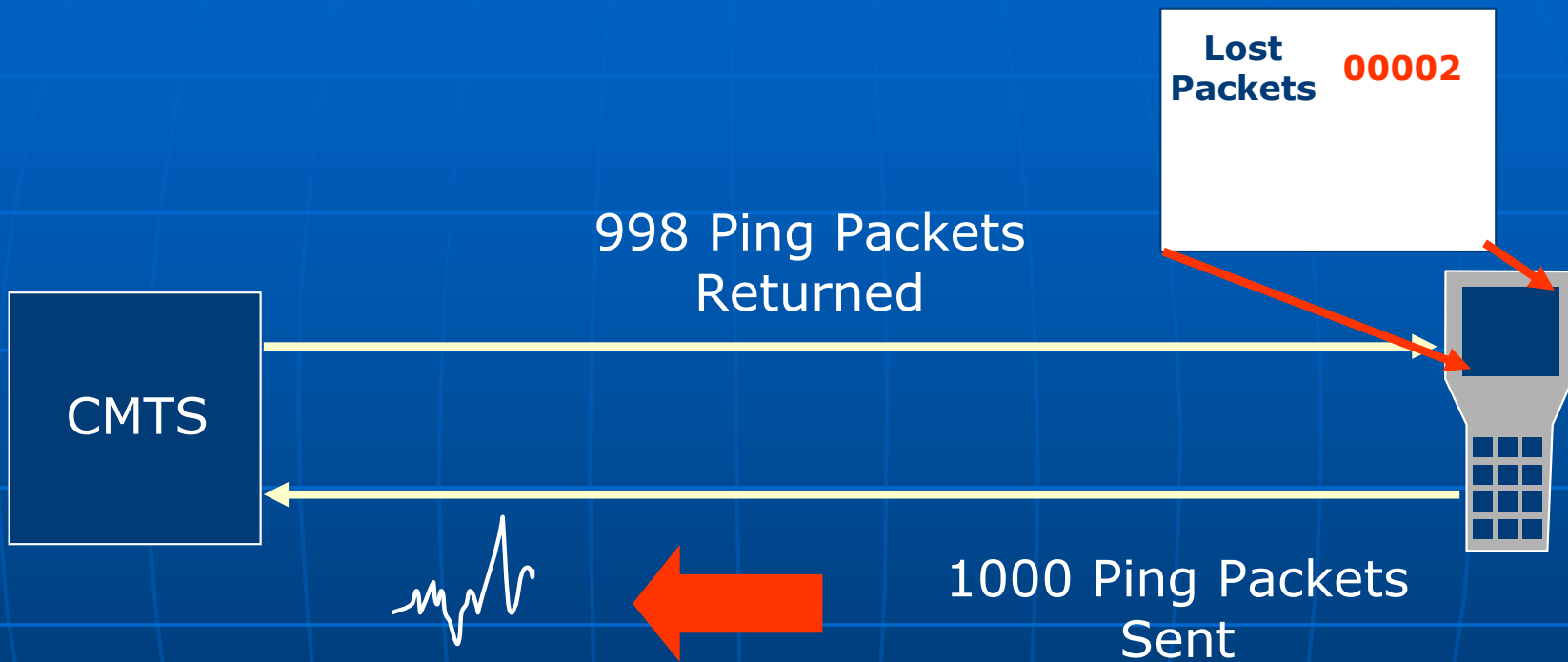


Packets Lost in Upstream

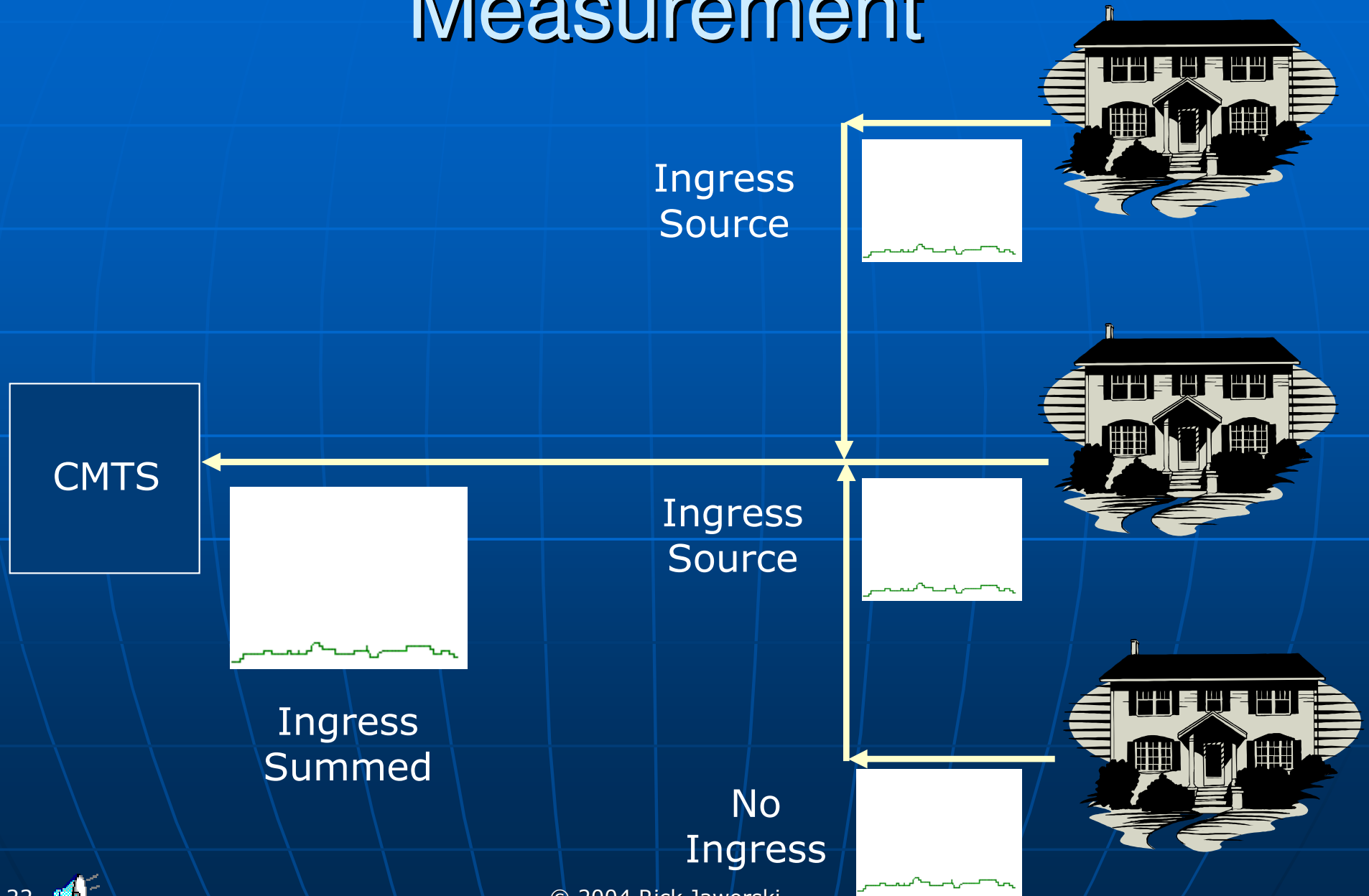
Instrument counts packets that don't return because they are lost in the Upstream



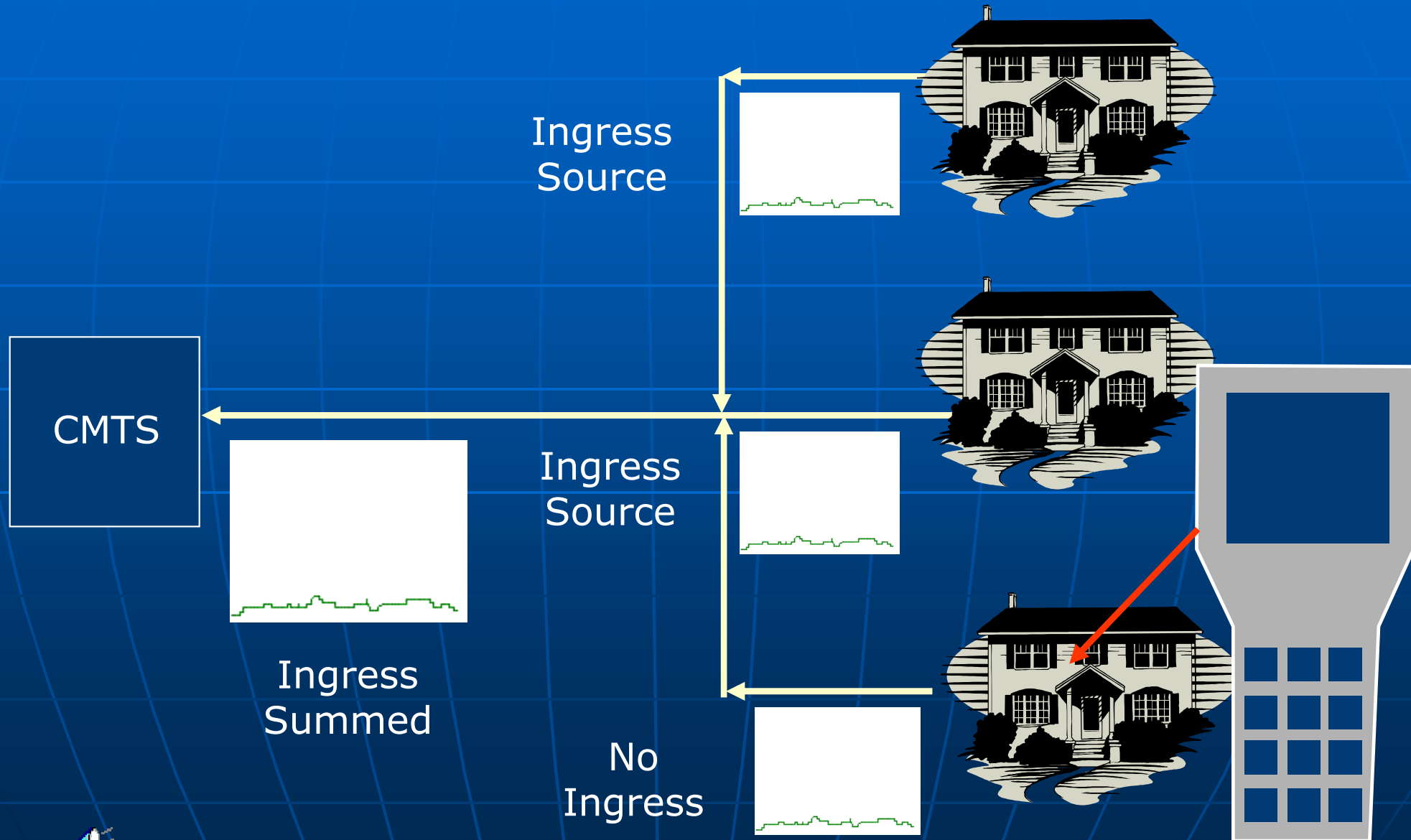
Upstream Lost Packet Measurement



Advantages of Lost Packet Measurement

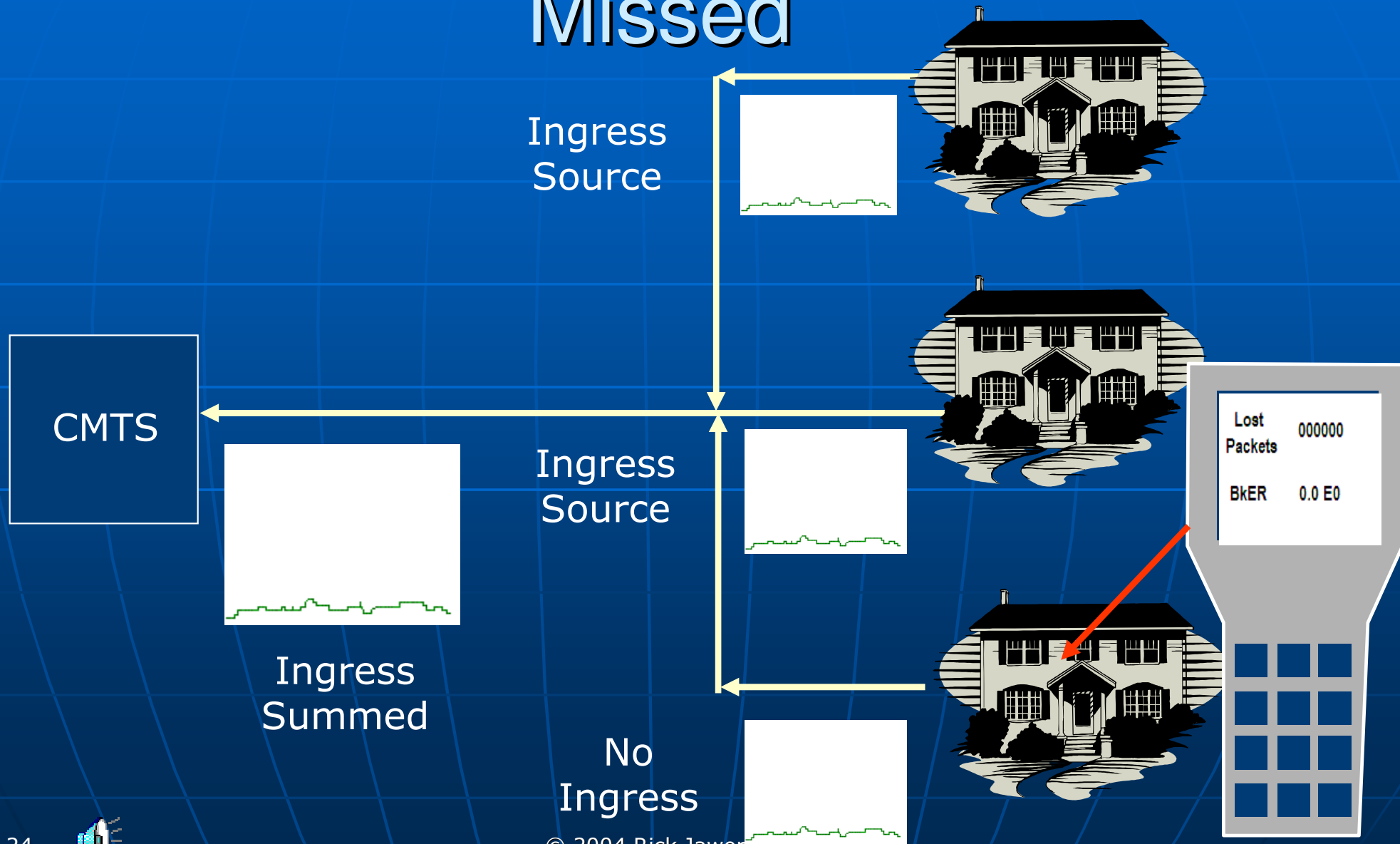


Advantages of Lost Packet Measurement

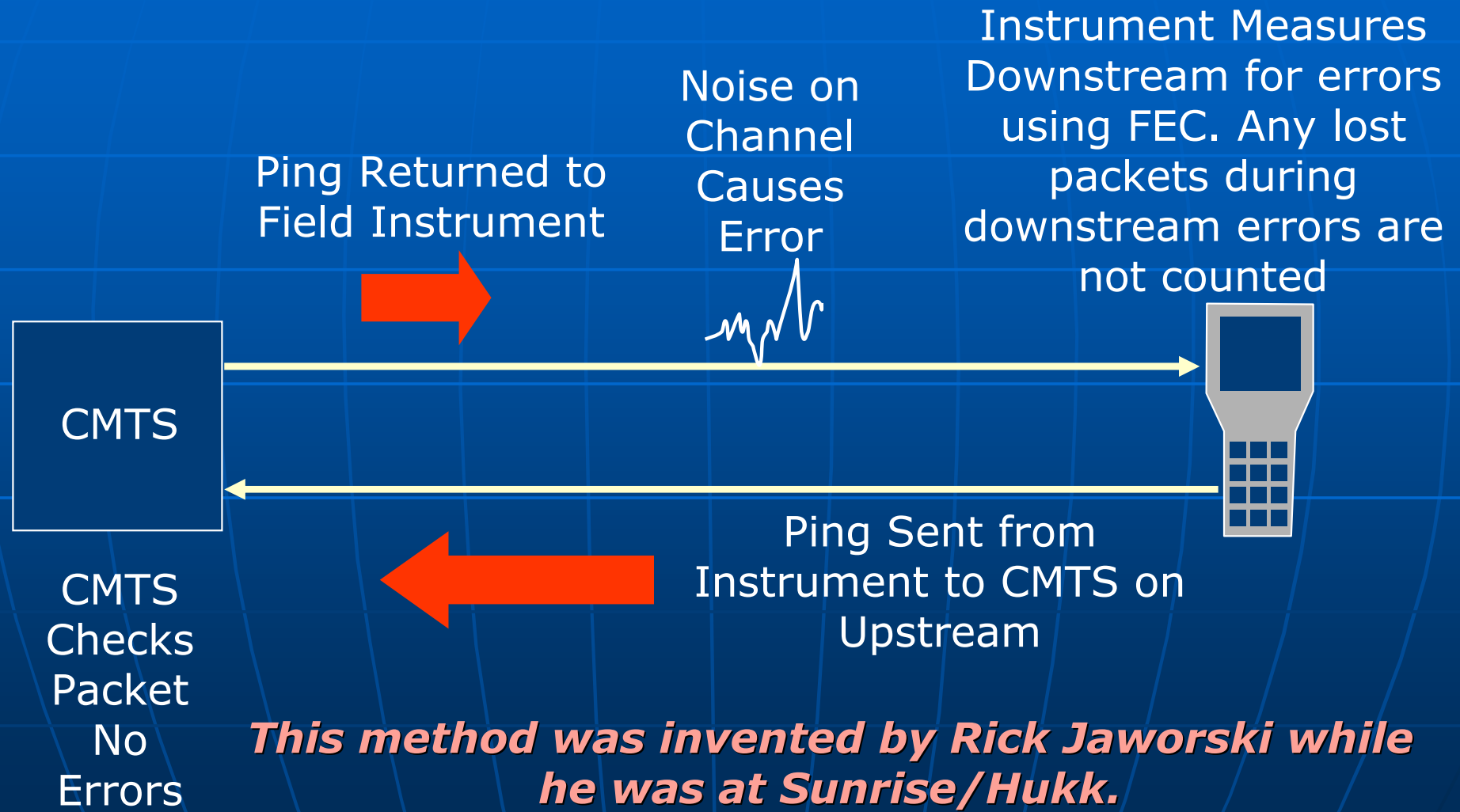


Lost Packets Measurement Identifies Problems Field Spectrum

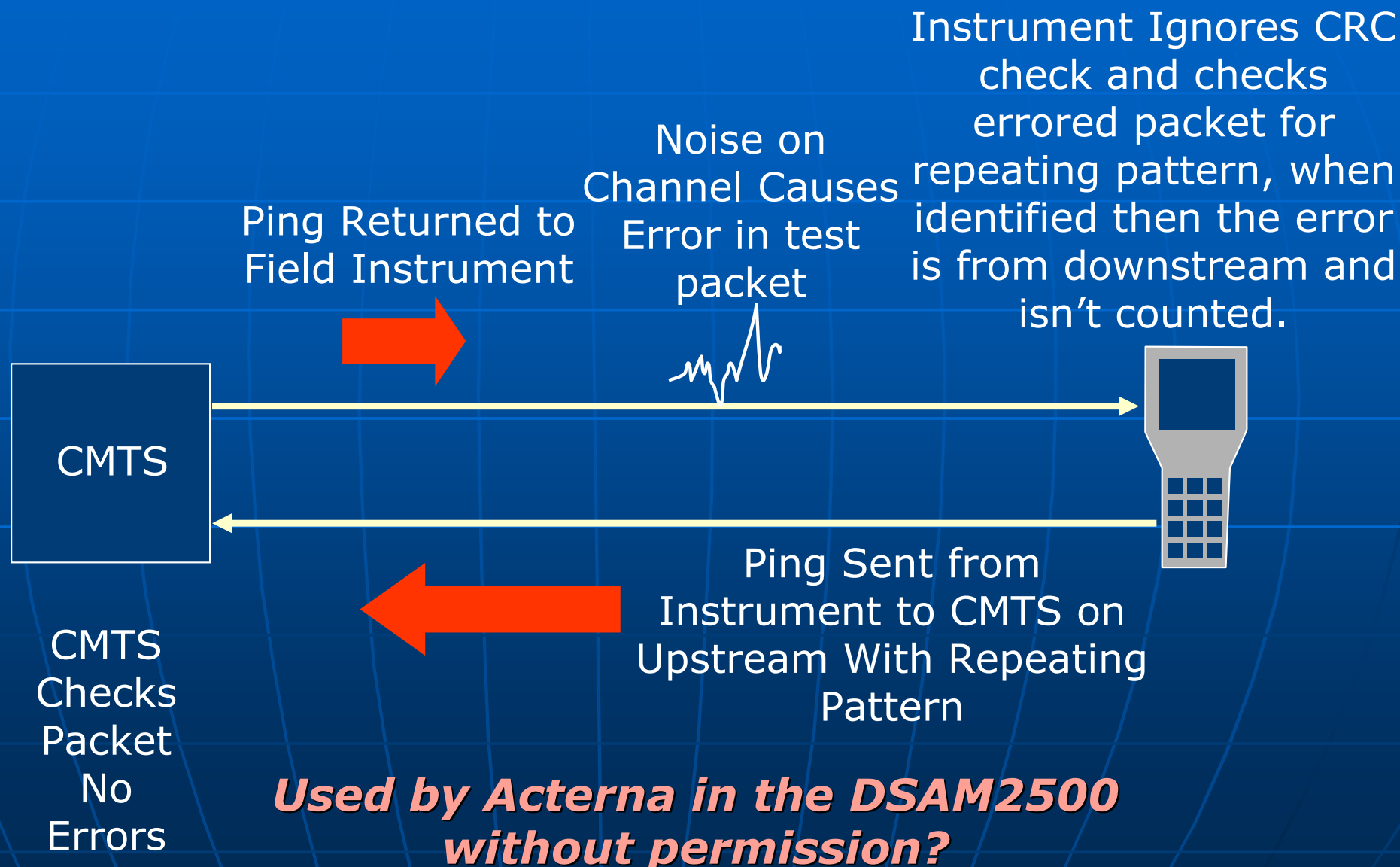
Missed



Sunrise Telecom FEC Method For Isolating Upstream and Downstream



Rick Jaworski's Patent Pending CRC Method for Isolating Upstream Errors



Used by Acterna in the DSAM2500 without permission?

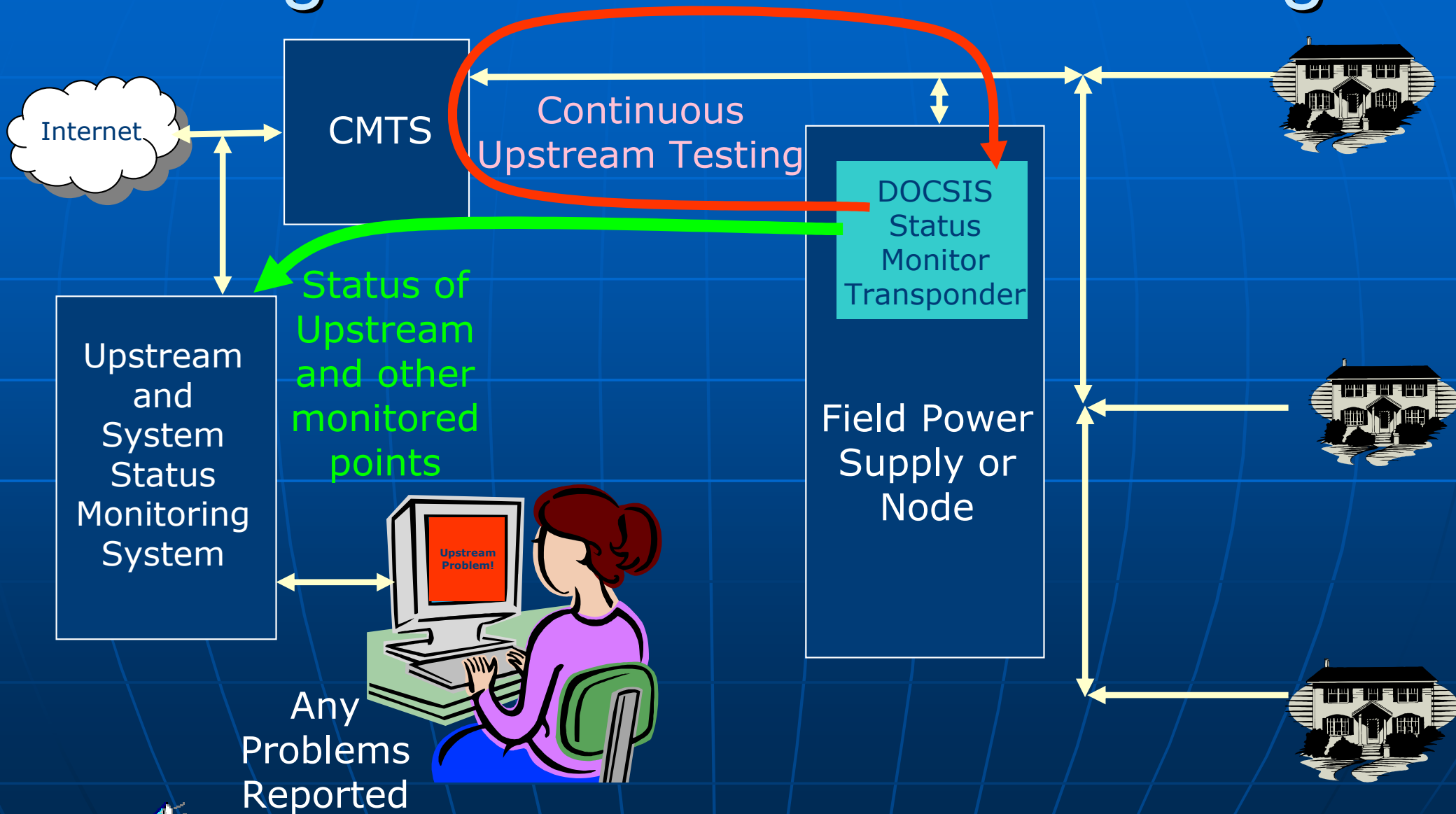


Status Monitoring Using DOCSIS

- A number of companies have introduced status monitoring systems using DOCSIS Cable Modems.
- This is a low cost, highly effective method for monitoring power supplies and other field devices.
- These systems leverage on the already installed DOCSIS infrastructure to provide a low cost reliable system.



Return Path/Upstream Monitoring Using DOCSIS Status Monitoring



Conclusions

- VoIP is poised to become the next “killer App” in cable.
- The upstream DOCSIS path is the “weak link” in VoIP over cable.
- Testing and monitoring the upstream will be necessary to provide high quality VoIP.
- Spectrum scanning return path monitors can miss fast transient ingress.
- Simply pinging the CMTS doesn't tell you if packets are lost in the upstream or downstream
- The CRC method of identifying upstream lost packets is more accurate in the presence of downstream errors.
- DOCSIS based status monitoring systems can also be used to monitor the return path and provide a low cost highly effective method of determining upstream problems.



Thank You for Listening

Questions?

Email rick@rickjaworski.com

