



# Company & Product Overview

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# Company Overview



- ◆ Established in 2000 by Ben Greear, CEO, author of Linux VLAN code.
- ◆ Address a niche of affordable real world network traffic generation equipment – LANforge FIRE.
- ◆ Initially, HW based but moved to COTS HW with advantages of realism.
- ◆ Architecture facilitated development of network emulation equipment – LANforge ICE.
- ◆ Proponents of the Open Source advantage and the value proposition for our customers.

# Sales Process

## ◆ Winning sales:

- LANforge is typically the most affordable option.
- Feature set is near the top of the industry.
- Currently, no other solution supports line-speed GigE and virtual-routing capabilities, in conjunction with integrated LANforge-FIRE traffic generation feature set.
- Small company means excellent tech & pre-sales support. There is only top-tier support, no bottom-tier out-sourced support staff to waste customer's time.
- Flexible licensing that does not restrict deployment topologies, i.e. move LANforge from lab testing to field testing is not restricted.
- Able to add reasonable customer requests in timely manner, independent of road map.

# Sales Process

## ◆ Notable LANforge ICE sales wins:

- Large gaming companies (Sony, THQ, Activision, Vivendi, VMC) use LANforge for online game testing, with excess of 80 concurrent emulations per system.
- Ernst & Young repeatedly buy large systems to emulate 8 concurrent high-speed emulations.
- Military & Aero-space companies: Lockheed Martin, Navy, SAIC, Raytheon, General Dynamics.
- Many other organizations: International banking, state & federal, foreign military, telecoms, etc.



Search

<http://www.candelatech.com>  
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+1 360 380 1618 [PST, GMT -8]

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## Network Testing Solutions



LANforge FIRE generates network traffic at various speeds with the ability to monitor packets for throughput and correctness. LANforge FIRE sits on the edge of your network and tests your network core.

[More Info](#)

### LANforge ICE



LANforge ICE emulates networks that involve limited bandwidth, latency, packet loss, and corruption. LANforge ICE tests the behaviour of devices that sit on either side of an impaired network. [More Info](#)

All LANforge systems include a platform independent [Graphical client](#) and a [scriptable](#) telnet management interface for automated testing. For examples of how the LANforge system can help with your testing needs, see the [LANforge Overview](#).

## NEWS!

### [Game Developers Conference 2008](#)

February 18-22 - San Francisco, CA - Moscone Center

[Booth 5546 North Hall](#)  
[NH Floor Plan](#)

Be sure to stop by our booth to see our [CT970](#) demonstration, a 24-port WAN Emulator capable of impairing the network connections of 24 individual gaming consoles. Grab a T-shirt and see how good your fragging skills are with 200ms of random jitter! Or try any of the other impairments available with [LANforge ICE](#). Please [contact us](#) for more information on how LANforge can help meet your network game testing needs.

# LANforge Links



- ◆ Support Mailing List:

<http://www.candelatech.com/mailman/listinfo/lanforge>

- ◆ Download Presentations and Datasheets:

<http://www.candelatech.com/pdfs>

- ◆ Self Guided Training - Cookbook:

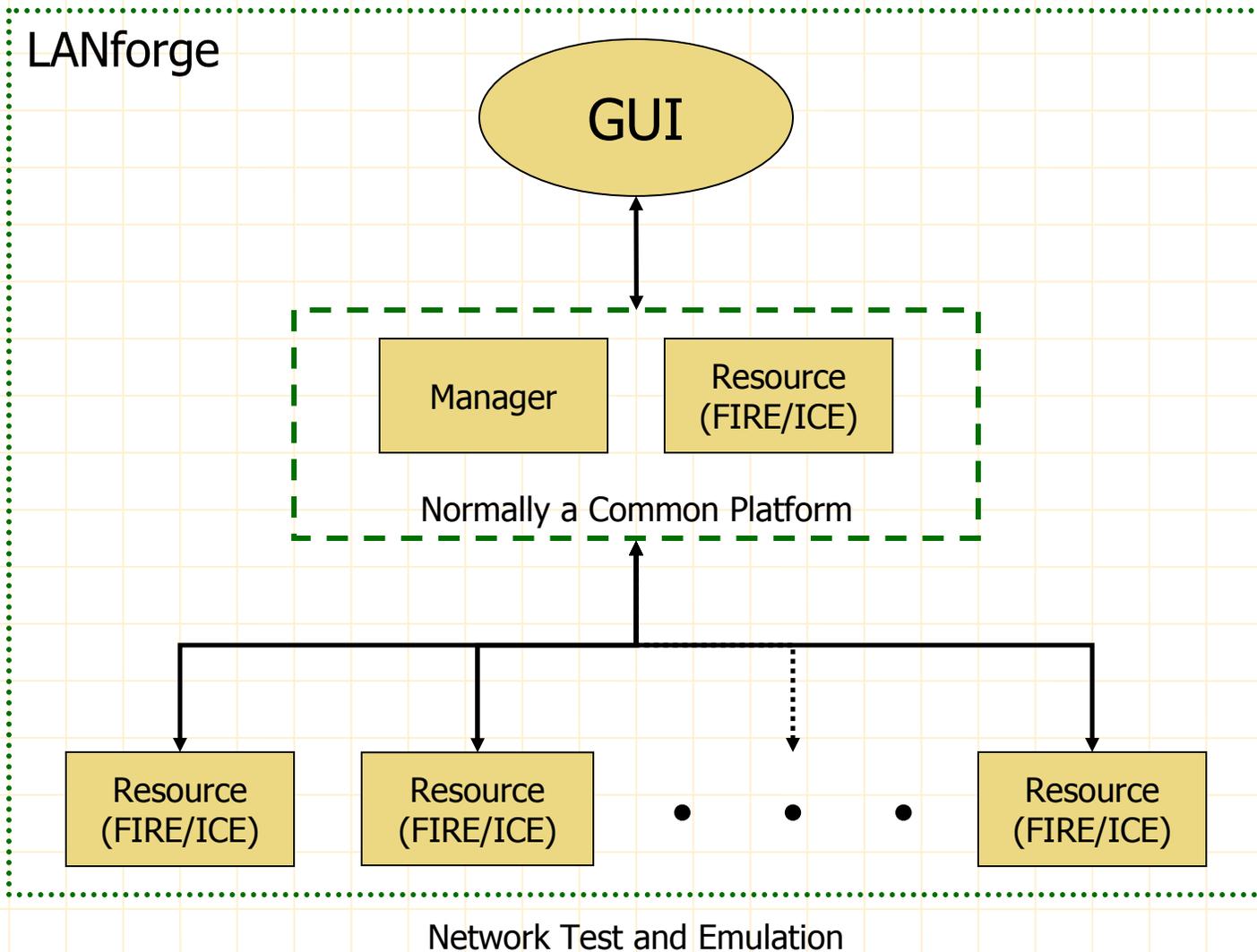
[http://www.candelatech.com/lanforge\\_v3/lfgui\\_cookbook.html](http://www.candelatech.com/lanforge_v3/lfgui_cookbook.html)

- ◆ Documentation and FAQ:

<http://www.candelatech.com/doc.html>

<http://www.candelatech.com/wiki/index.php/LANforge-FAQ>

# System Architecture



# System Elements



- ◆ The **System**: GUI, Manager and Resources
- ◆ The **GUI**: Displays and records data reported by the Resource Manager. Generates control and configuration requests to the Resource Manager.
- ◆ A **Manager**: Only one in a system that performs data collection, configuration, control, licensing and can also be a Resource.
- ◆ A **Resource**: Network Traffic Generator (LANforge FIRE) and/or Network Emulator (LANforge ICE).

# System HW Features



- ◆ Form factor support: Compact Network Appliance, Near Silent Appliance, Shuttle PC, PC, Rack Mount Server, Laptop, Rugged Portable PC. Compact form factors good for customer demos, on-site support and desktop development. Other form factors give flexibility in deployment.



Compact Network Appliance



WiFi Compact Network Appliance



1U Rackmount Appliance

# System HW Features



Compact Near Silent Appliance



Rugged Portable PC

- ◆ Interface support: 10/100/1000/10Gbe copper/fiber ethernet, 802.11a/b/g, T1/E1 and even Token Ring! Using generic interface HW allows cost effective reuse of LANforge investment.
- ◆ Speed support: 10 bps to 1 Gbps FDX, +1 Gbps available. Provides an affordable broad performance envelope.
- ◆ Sub-millisecond precision and accuracy attainable without the need for custom HW.

# System SW Features



- ◆ Standard HW support x86-32/64 allows the use of COTS HW.
- ◆ Linux supported: FC2–8. Unofficially supported: SUSE, Debian and others. Customers can use an existing and familiar distribution to reduce the learning curve.
- ◆ Windows (minus Armageddon, VLANs, Virtual-Routers, NAT, DHCP) gives flexibility in deployments for existing platforms.
- ◆ Live-CD allows complete temporary installation of LANforge on any platform to increase the number of LANforge resources without additional investment in HW.
- ◆ JAVA based GUI that is GPL'd enables localization and customization.

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# System SW Features



- ◆ Scriptable interface helps automate testing. Perl scripts provided free.
- ◆ Automated DB backup to preserve previous test configurations.
- ◆ Spreadsheets exported in standard CSV enable graphing of collected data for engineering analysis and management reports.
- ◆ Multiple users can share a LANforge system thereby leveraging investment. User administration feature prevents friendly fire.
- ◆ 802.1q VLAN trunking support allows LANforge to be shared lab resource through network architecture.
- ◆ Remote sniffing of packets from any LANforge interface for efficient debugging of problems.

# LANforge ICE Features



- ◆ Standard impairment control: speed, latency, jitter, loss, reorder & duplication.
- ◆ Packet Corruption Control allows user to specify the corruption location within a packet, the type of corruption and the percentage of packets to be affected by the corruption.
- ◆ WANpath supports MAC or IP filtering to apply impairment behaviour on specific flows.
- ◆ Bridged or routed mode for easy integration into customer network architectures. Virtual routers support OSPF.
- ◆ NAT and DHCP client and server emulation aids network integration and testing. NAT supports port forwarding.

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# LANforge ICE Features



- ◆ WAN Replay reproduces latency profile captured with the ICEcap tool.
- ◆ ICEcap captures latency profiles in an editable XML file for replay in ICE.
- ◆ Packet dump feature captures packet flows for replay in LANforge FIRE traffic generator.
- ◆ LANforge ICE runs on LANforge kernels or standard Linux kernels.
- ◆ WISER (Wireless IP Scalable EmulatoR) sub-system emulates mobile military wireless networks with terrain, propagation and radio impairments to IP traffic. Developed in partnership with Telcordia.

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# LANforge ICE Features



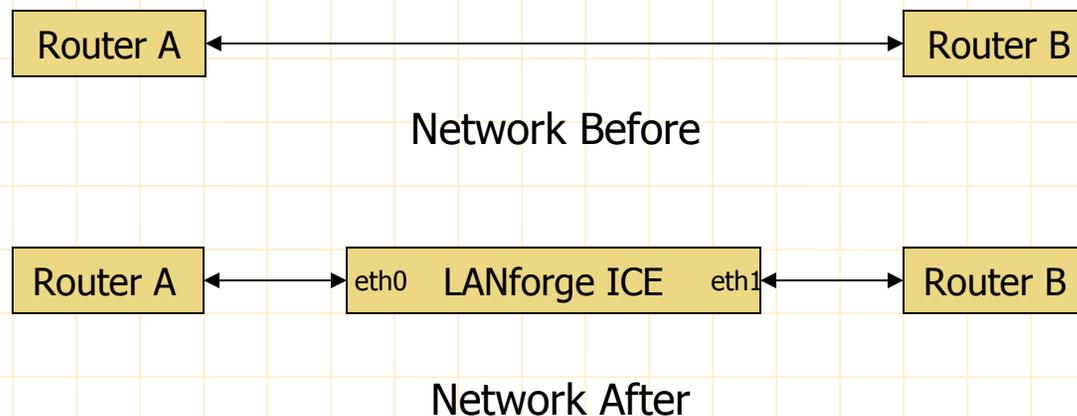
- ◆ QoS queue supported: FIFO and WRR.
- ◆ Wireless collision domain emulation.
- ◆ Optional simplified LANforge ICE GUI reduces user learning curve.
- ◆ Virtual WiFi Access Point emulation.
- ◆ Able to induce delay of 8000 ms @ GigE speed. Equivalent of 1.5 million miles or 23.35  $\mu$ ly (micro light-year).
- ◆ Netsmith feature provides GUI for virtual network configuration and control.

# LANforge ICE Applications



## ◆ Bridged

- Simplest way to integrate LANforge ICE into your network.
- Does not require any configuration changes to the network.
- Will bridge all 802.1q VLANs transparently.

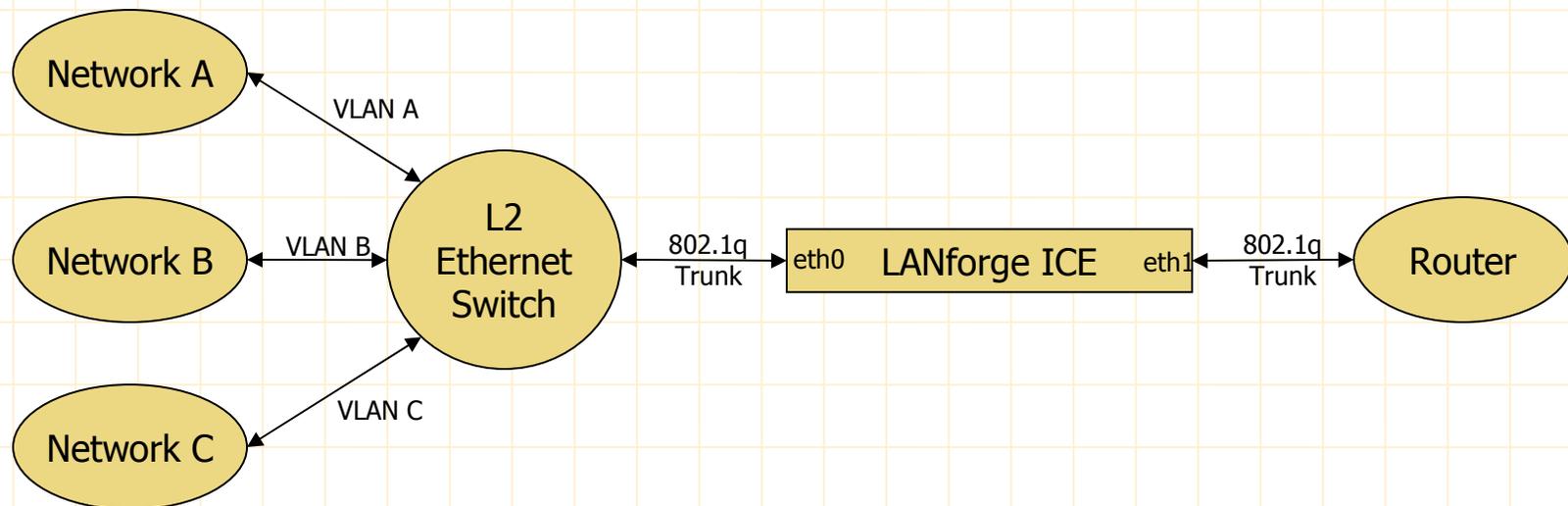


# LANforge ICE Applications



## ◆ 802.1q Trunking

- Allows different networks/VLANs to experience different impairments.
- LANforge ICE can be a shared resource using only two physical interfaces.

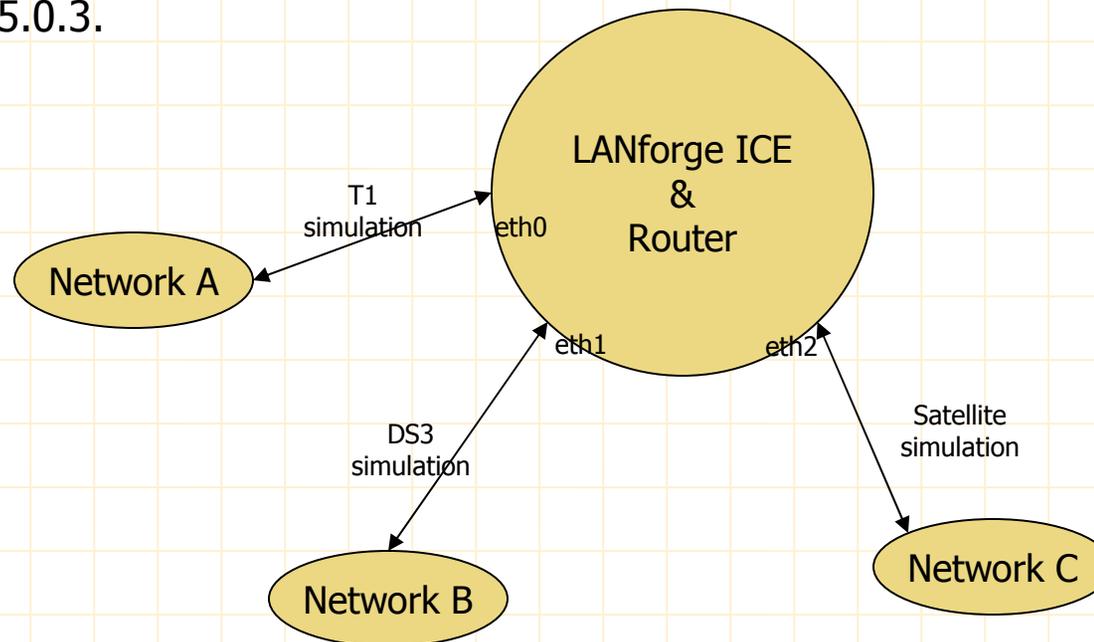


# LANforge ICE Applications



## ◆ Routed

- Through routing LANforge ICE is able to provide multiple simulation flows as well as multiple routers. DHCP and NAT will be supported in release 5.0.3.



# LANforge ICE Road Map



- ◆ Release 5.0.8 targeted availability August 1, 2009:
  - Increase scalability of virtual network elements.
  - Optimize 10Gbe performance.
  - GUI based script configuration and execution.
  - Multiple Resources in Netsmith.
  - Continue to simplify and improve GUI.
  - WanLink optimisation to support > 1 Gbps bi-directional.

# LANforge ICE Road Map



- ◆ Future releases:
  - Application Layer ICEcap:
    - Support protocols other than ICMP for more realistic profiling.
  - Advanced Impairments:
    - WANpath filter on port, protocol and other parameters.
    - Impairments based on statistical models.
    - Additional impairment types.
    - Time Varying Network Impairments to help satisfy TIA-921 and ITU G.1050, e.g. bursty background traffic on emulations.
    - Expand QoS emulation.
    - Better support for emulation broadcast domains.

continued...

# LANforge ICE Road Map



- ◆ Future releases:
  - Advanced Impairments:
    - Replay Netflow/IPFIX Capture Characteristics.
    - Impairments based on statistical profiles.
  - Support Other routing protocols BGP, RIP, etc.
  - Netsmith show multiple Resources at one time.

# LANforge ICE Case Study



## ◆ Purpose:

- Demonstrate the advanced capabilities and benefits of the LANforge ICE WAN emulator.

# LANforge ICE Case Study



## ◆ Customer Problems:

- Customer suffered significant monthly expenditure maintaining live network resources (Cable and DSL modems) from local service providers to simulate networks in their online testing.
- Reproducing field problems proved virtually impossible due to differing behaviour of the local network compared to the network where the problems occurred.
- Debugging problems consumed significant resources.
- Lack of repeatable impairment profiles meant that emulated network tests were omitted from regression tests.

# LANforge ICE Case Study



## ◆ LANforge Solution:

- Using the 802.1q VLAN feature and Linux bridging LANforge ICE emulates network topology that the customer was using for online testing.
- ICEcap allows customer to capture the field problem network impairment profile over a period of time and replay impairments in ICE.

# LANforge ICE Case Study



## ◆ Benefits:

- Reduction in monthly expenditure.
- Reproducibility of local network and WAN impairments.
- Improved resolution times of field problems.

## ◆ Additional Benefits:

- Database of captured network profiles for regression testing.
- Increased number of online testing resources from approximately 50 to 80 without additional HW cost.
- Multiple testers are able to configure their own impairment profiles and share the same LANforge ICE system.

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# LANforge ICE Case Study



## ◆ Additional Benefits:

- Regression testing.
- Reduced development cycle with partners.
- Reduced tester configuration of test consoles through DHCP.

# LANforge ICE Case Study



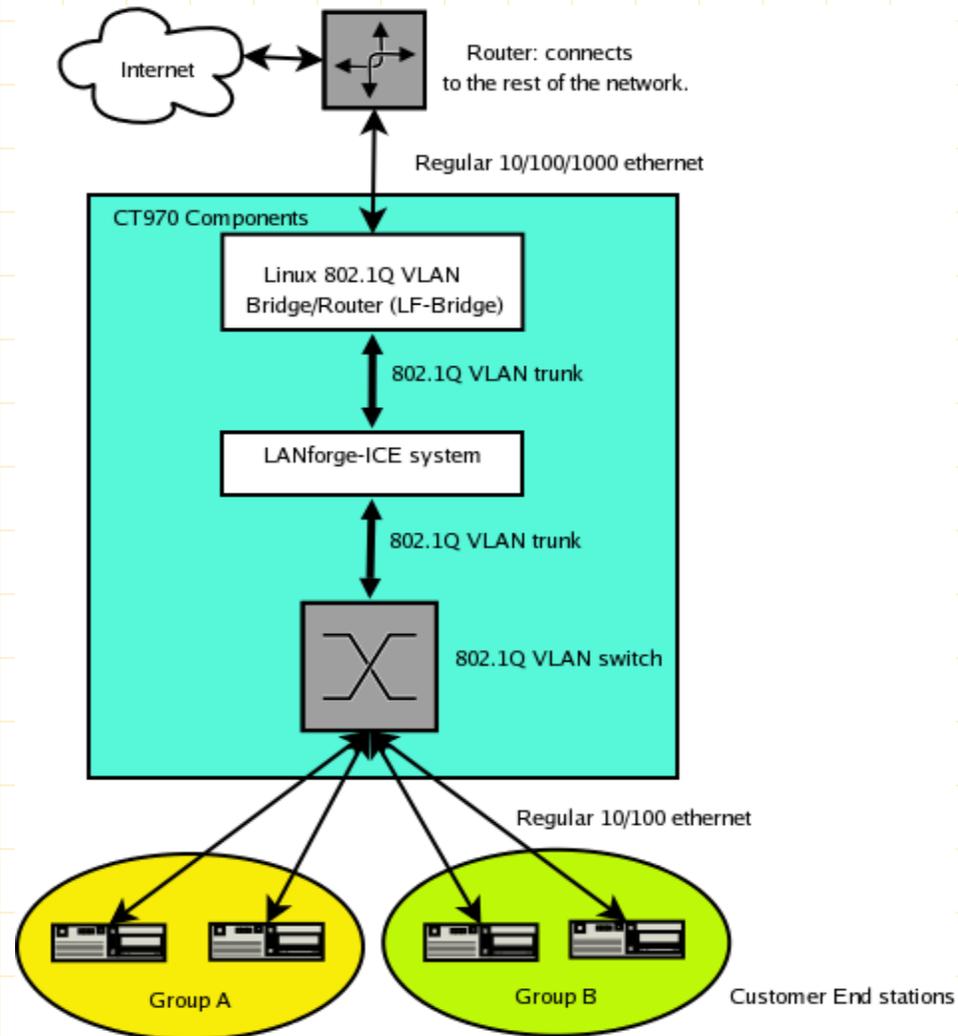
◆ CT970-X System:



# LANforge ICE Case Study



## ◆ Diagram



Network Test and Emulation

# LANforge ICE Case Study



## ◆ Solution Diagram Detailed Description:

- LF-Bridge is a standard Linux machine supporting routing and bridging. Logically, each customer end station has a network interface on the LF-Bridge. The customer can thus group the end stations into the same broadcast domain (LAN) in whatever configuration is desired. The LF-Bridge system can route between bridge groups, so the Group A end stations can talk to each other via normal LAN broadcast and can talk to Group B through routing. All stations will talk through the LANforge-ICE system regardless of which other stations they are communicating with.
- The LANforge-ICE system can have a large number of 802.1Q VLAN interfaces. Each physical port on the LAN switch maps to a separate VLAN, and the LANforge-ICE WAN emulation is applied to specific VLANs. This allows a large number of distinct WAN emulations with a single LANforge machine.

continued...

# LANforge ICE Case Study



## ◆ Solution Diagram Detailed Description:

- The 802.1Q VLAN switch has one interface configured as an 802.1Q VLAN trunk. This port connects to LANforge. The other interfaces will be configured such that each interface is mapped to a particular VLAN. Untagged ethernet frames are sent to and received from the Customers End station(s).
- The Customers' End stations speak regular ethernet and plug into the 802.1Q VLAN switch. If the LF-Bridge system is set up as a router, the end stations will use their associated bridge interface as their default gateway. The LF-Bridge can also be configured to be completely transparent. In this case, the end stations will use the existing network infrastructure connected to the LF-Bridge as the router.
- Reference: [http://www.candelatech.com/images/ice\\_vlan\\_bridge.png](http://www.candelatech.com/images/ice_vlan_bridge.png)

# Testimonial #1



- ◆ Bridger Funding used LANforge ICE to test the deployment of a new network architecture. LANforge ICE exposed some problems during the test phase, when it was still possible to fix them!

*"Thank you very much for this product and all of your help answering my crazy questions. This product has saved us a ton of time in testing out different scenarios and an equal if not greater amount of money from deploying a bad solution to the company!"*

-- System Administrator

# Testimonial #2



◆ AP Connections <[www.apconnections.net](http://www.apconnections.net)>:

You've reached a quintessential point in business when your product has no service effecting issues. NetEqualizer has arrived at that point. For the last six months, no issues have surfaced. None. Any "problems" have been system-specific and surmountable, usually easily. It's a great feeling.

We have to give credit where credit is due, and that would be to say that the recent surge in reliability is a direct result of an informal partnership with Candela Technologies.

continued...

# Testimonial #2 continued



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As you can imagine as with all products installed in a network, reproducing subtle field issues in a test lab can be maddening. But Candela does it reliably. With their Lanforge line of equipment you can root out almost any issue in your network. It is what we use in house and the pay-off is immeasurable.

Thanks, Candela Tech; we both get bragging rights to your results.

# Demo: Objective



- ◆ Illustrate basic LANforge FIRE and ICE functionality using a single appliance.
- ◆ Demonstration realized by using virtual re-direct devices (<http://lwn.net/Articles/130389/>) which can have more advanced applications such as routable ICE WAN emulation.
- ◆ Platform:
  - <PUT SPECS HERE>

# Demo: References



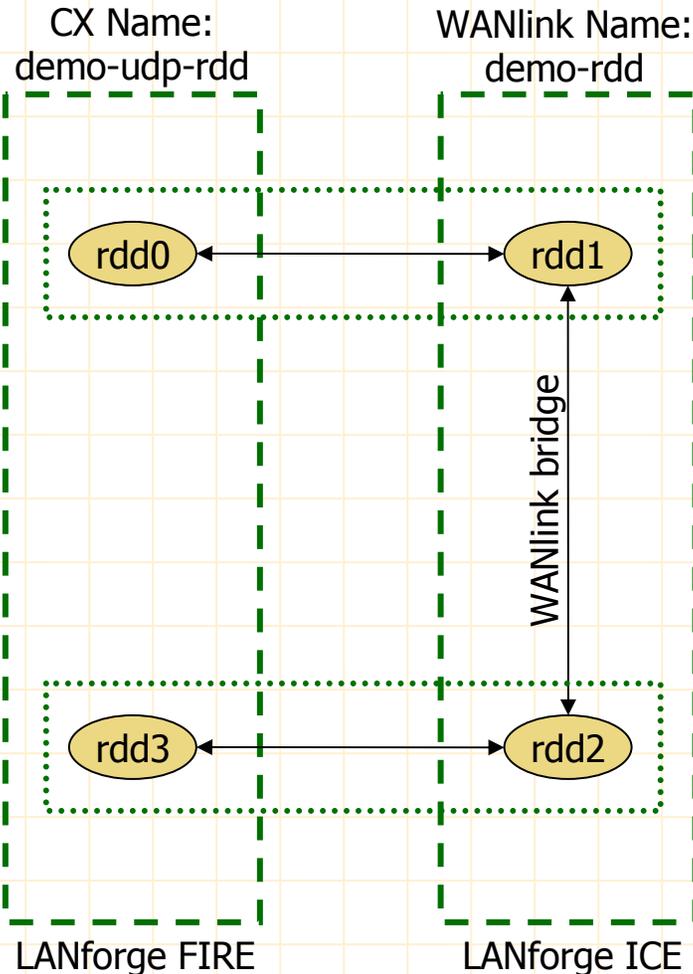
- ◆ Online: <http://www.candelatech.com/doc.html>
- ◆ HELP button ☺
- ◆ Symbol ">" is a mouseActionClick
- ◆ Definition of Virtual Re-Direct Device:
  - RDDs (Re-Direct Devices) are created and associated in pairs. Transmitting a packet on one RDD cause the other RDD to receive the packet. RDDs are presented as regular ethernet devices and have MACs, will do ARP, and other such things.

# Demo: UDP Cross Connect



rdd0:  
IPAddress: 1.1.1.1/24  
Name: demo-udp-rdd-A  
TXSpeed: 1.024 Mbps  
PacketSize: 300 bytes  
PldPattern: Increasing

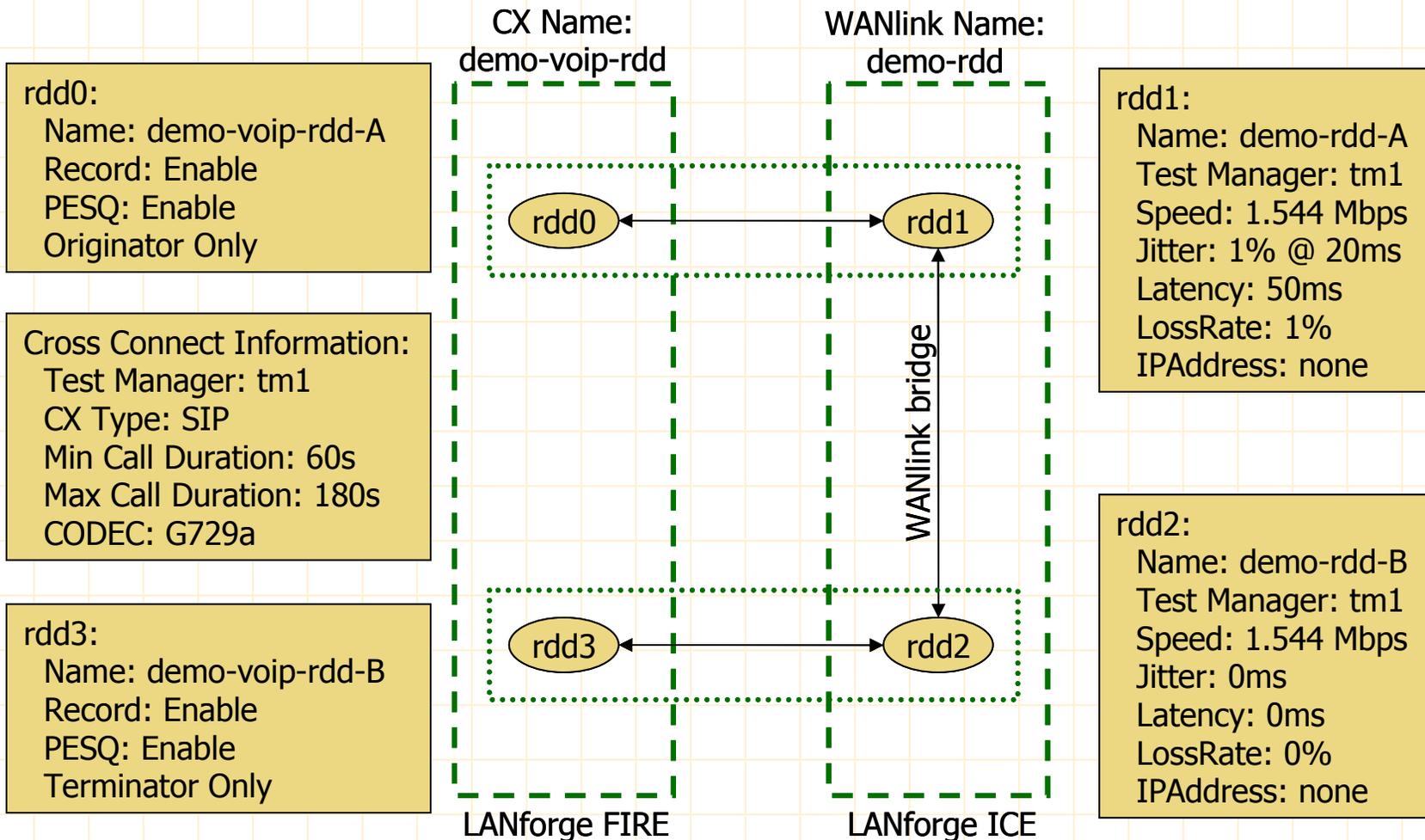
rdd3:  
IPAddress: 1.1.1.2/24  
Name: demo-udp-rdd-B  
TXSpeed: 1.024 Mbps  
PacketSize: 300 bytes  
PldPattern: Increasing



rdd1:  
Name: demo-rdd-A  
Test Manager: tm1  
Speed: 1.544 Mbps  
Jitter: 1% @ 20ms  
Latency: 50ms  
LossRate: 1%  
IPAddress: none

rdd2:  
Name: demo-rdd-B  
Test Manager: tm1  
Speed: 1.544 Mbps  
Jitter: 0ms  
Latency: 0ms  
LossRate: 0%  
IPAddress: none

# Demo: VoIP Cross Connect



# Demo: Connect to LANforge



- ◆ >Discover, >Connect
- ◆ >Server Name/IP: [yourLANforge]:4002, >Connect
- ◆ >Control, >Connect
  
- ◆ Status:
- ◆ Blue = Management Interface
- ◆ Green = Running Resource Interface
- ◆ Yellow = Phantom Resource Interface
- ◆ Link State and Negotiation

# Demo: Create rdds



- ◆ >Port Mgr, >Create, >Redirect, >First Redir Name: rdd0, >Second Redir Name: rdd1, >OK
- ◆ >Create, >Redirect, >First Redir Name: rdd2, >Second Redir Name: rdd3, >OK
- ◆ >Alias: rdd0, >Modify, >IP Address: 1.1.1.1, >IP Mask: 255.255.255.0, >OK
- ◆ >Alias: rdd3, >Modify, >IP Address: 1.1.1.2, >IP Mask: 255.255.255.0, >OK

# Demo: Create Test Mgr



- ◆ >Test Mgr, >Create, >Test Manager Name: tm1
- ◆ >Free Clients: default\_gui, >Add Client
- ◆ >Free Clients: default, >Add Client
- ◆ >OK

# Demo: Create WANlink



- ◆ >WanLinks, >Create
- ◆ >Name: demo-rdd, >Test Manager: tm1
- ◆ demo-rdd-A, >Port: rdd1, >Jitter-Freq: 10000, >Transfer Rate: 1544000, >Latency: 100, >Jitter: 20, Drop-Freq: 1000, >Kernel-Mode
- ◆ demo-rdd-B, >Port: rdd2, >Transfer Rate: 1544000, >Kernel-Mode

# Demo: Create UDP CX



- ◆ >Layer-3, >Create
- ◆ >CX Name: demo-udp-rdd, CX Type: LANforge/UDP, >Test Manager: tm1
- ◆ demo-rdd-A, >Port: rdd1, >Jitter-Freq: 10000, >Transfer Rate: 1544000, >Latency: 100, >Jitter: 20, Drop-Freq: 1000, >Kernel-Mode
- ◆ demo-rdd-B, >Port: rdd2, >Transfer Rate: 1544000, >Kernel-Mode

# Demo: Create VOIP CX



- ◆ >VOIP/RTP, >Create
- ◆ >CX Name: demo-voip-rdd, >Test Manager: tm1,  
>CX Type: Voice – SIP, >Min Call Duration: 60,  
>Max Call Duration: 180, >Codec: G729a
- ◆ demo-voip-rdd-A, >Port: rdd0, >Record, >Enable  
PESQ
- ◆ demo-voip-rdd-B, >Port: rdd3, >Record, >Enable  
PESQ

# Demo: Miscellaneous



- ◆ Poll Mgr
- ◆ Card Mgr

# Specifications



# Pricing

