Remote Operation of Light Source Beamlines with (Free)NX

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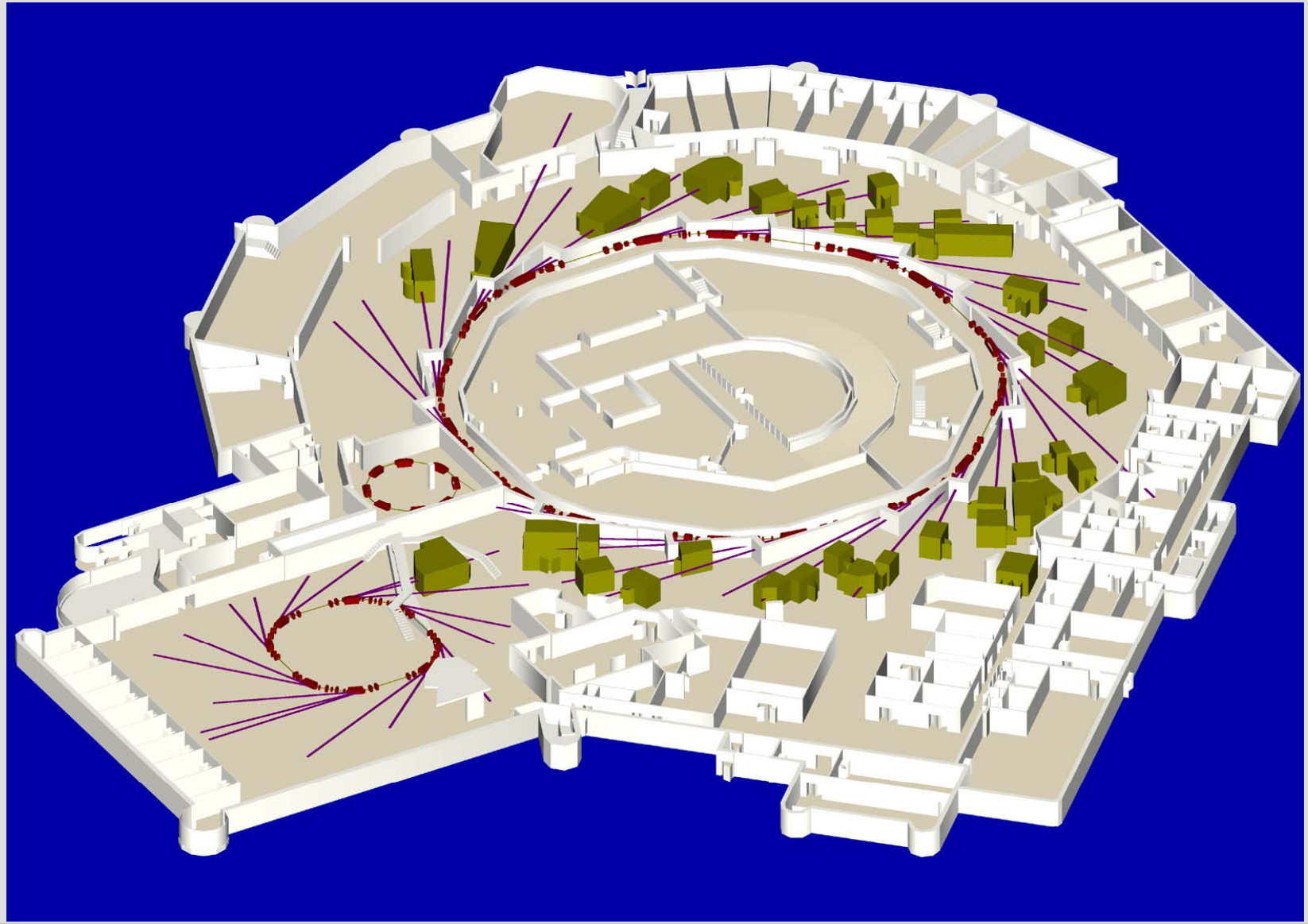
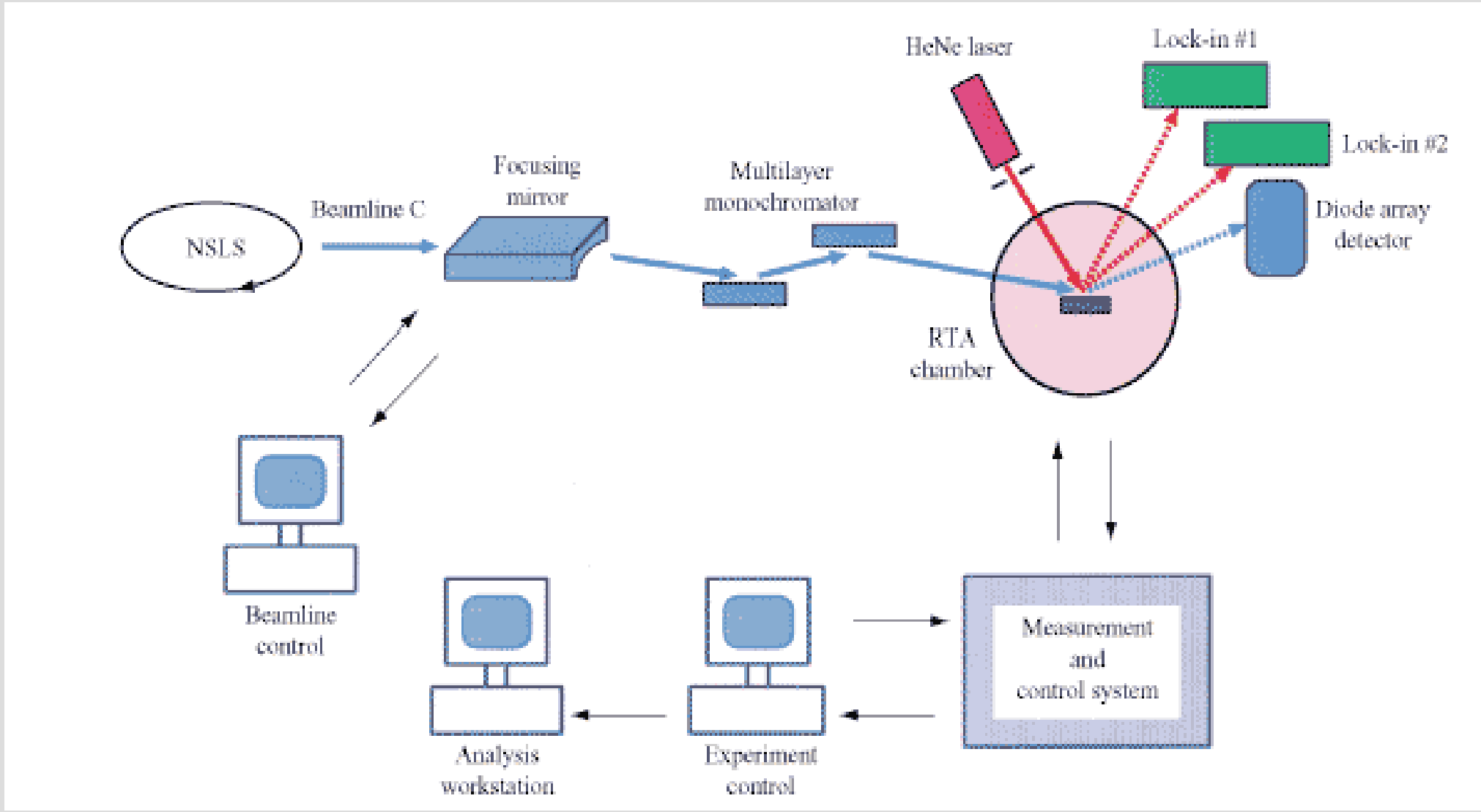
- Controls at NSLS Facility Beamlines
- What Is NX, FreeNX
- Cybersecurity Requirements at BNL
- Remote Operation with NX, ssh Tunneling
- Live Demo
- Concluding Remarks

Controls at NSLS facility Beamlines:
Light Source Beamlines



Controls at NSLS facility Beamlines:
A Typical Beamline Layout

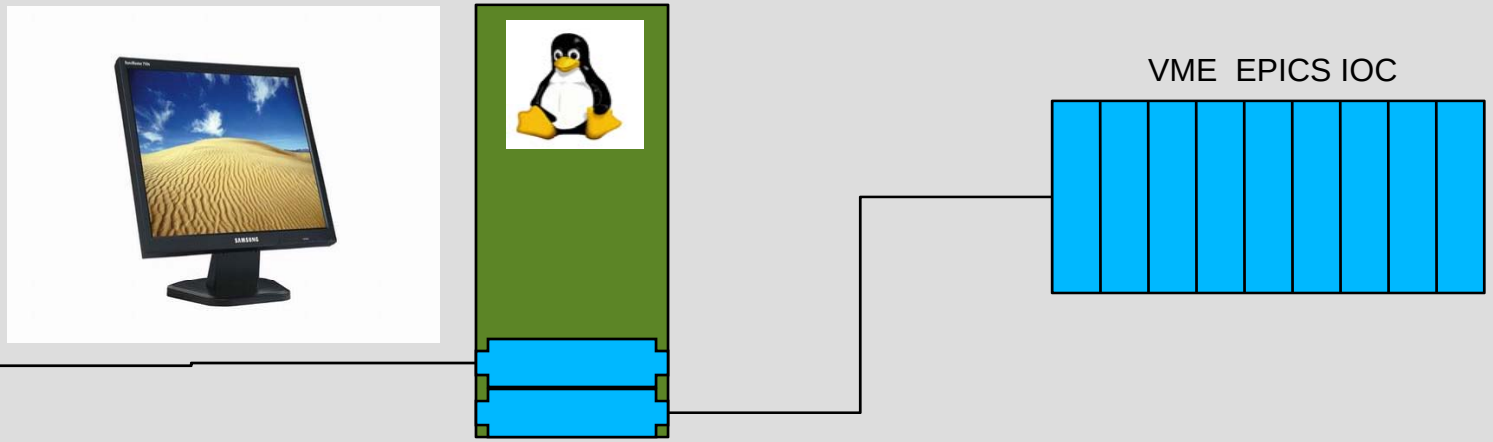


Controls at NSLS Facility Beamlines: Typical Network Configurations

- EPICS based, VME IOC for motor/scaler/ADC etc.
- Linux workstation, running EPICS clients
- Dual NIC cards:

  eth0: to internet

  eth1: private network for instrumentation



What is NX, freeNX

- X is a network protocol, X remote display, “ssh -XC” can be used for remote monitoring/operation
- Issues:
  - too much round trip traffic, network latency
  - long distance, unresponsive
- To achieve fast response the NX way:
  - Efficient compression
  - Proxy server and cache-files to reduce round trip x-traffic

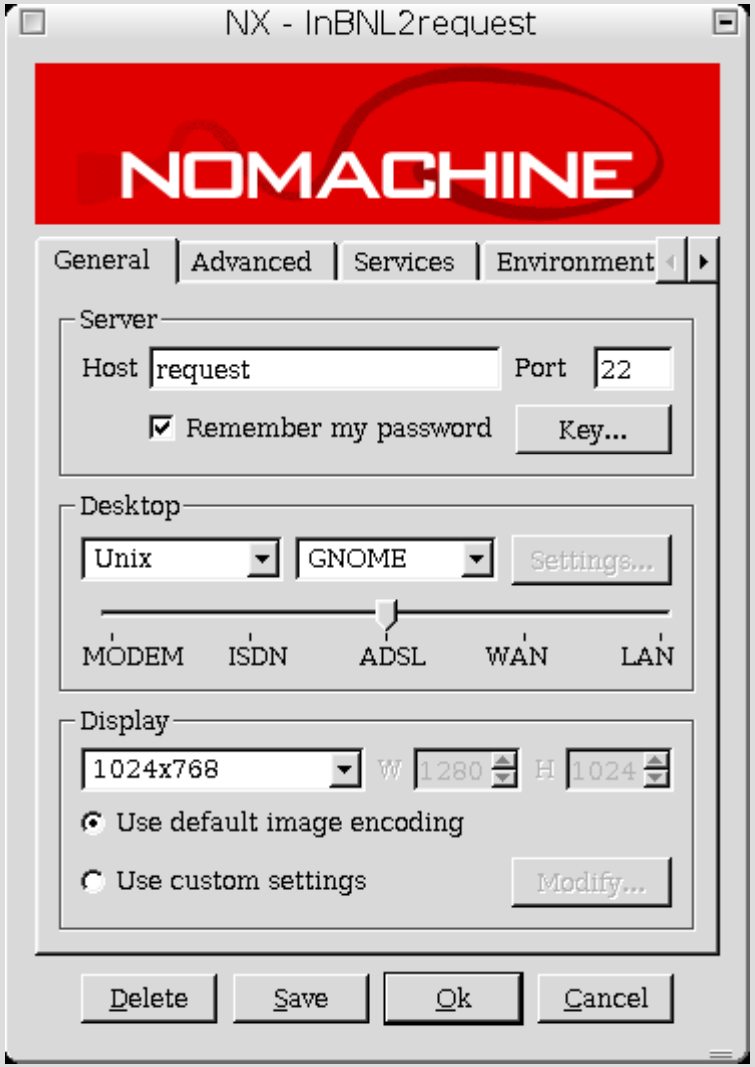
What is NX, freeNX: Continued

- Products at Nomachine.com:
  Servers – Personal server (2 connections) free
  - Business server $$$
  Client – closed source, but freely downloadable
  Windows, Linux, Mac
  NoMachine.com provides support
- Nomachine.com GPLed the core library
- FreeNX: based on the core library, a suite of shell scripts to make a GPLed NX server. Clients is in the works.

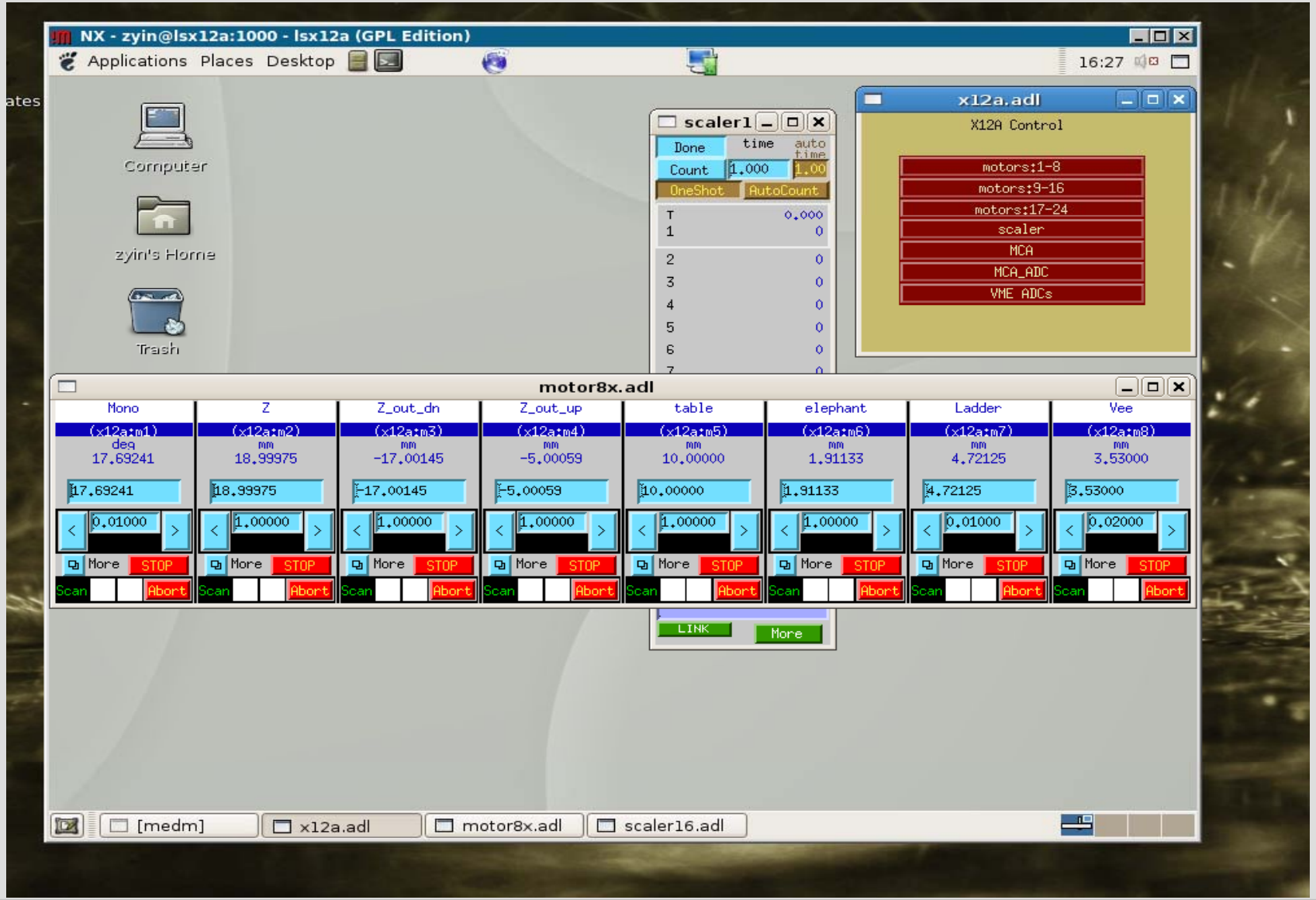
  FreeNX server works with NoMachine clients

What is NX, freeNX: Procedures

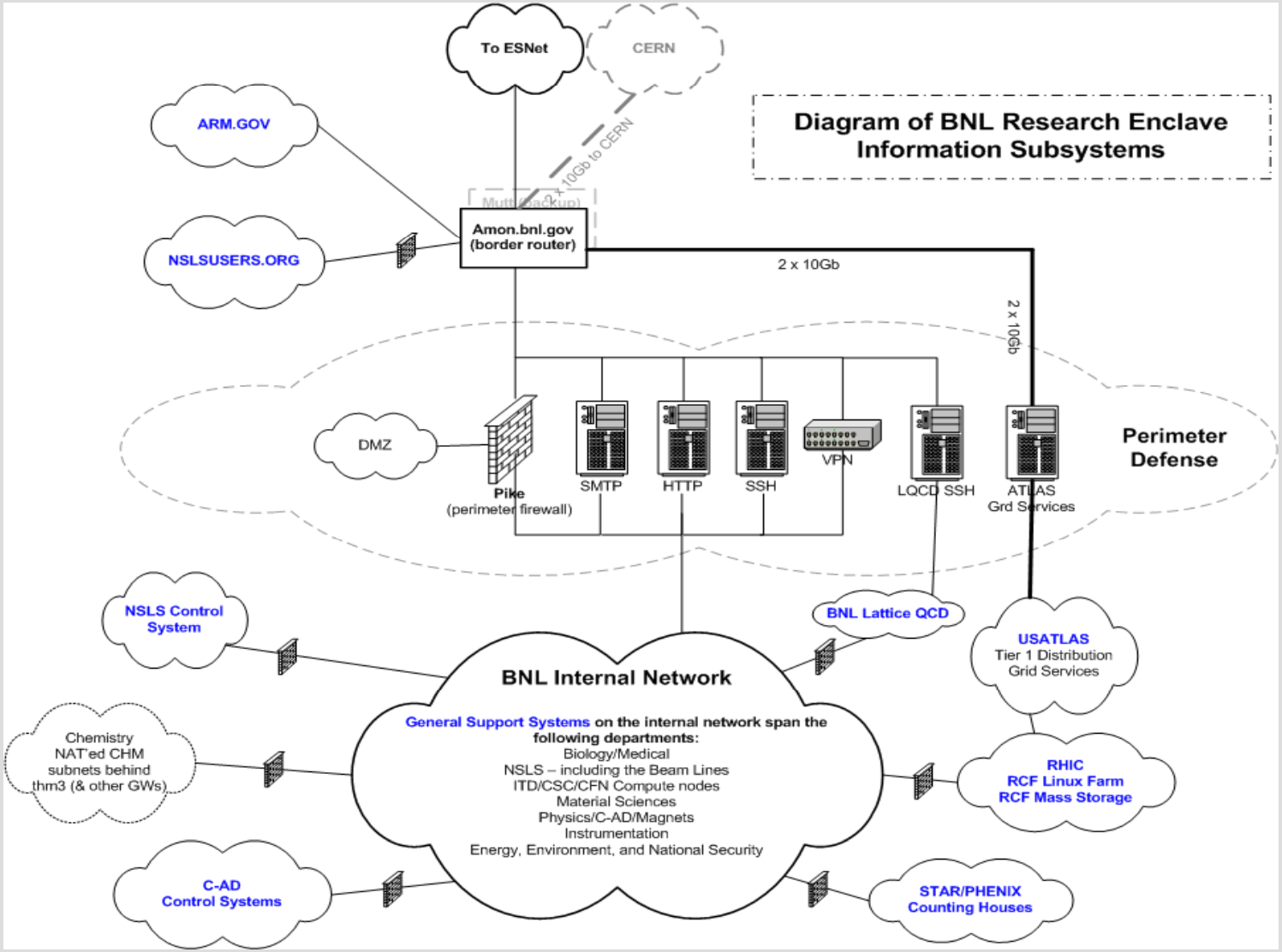
- Setup freeNX server, download packages (rpm, deb, etc.)
- Download NX clients from NoMachine.com
- Configure NX client



What is NX, freeNX:
Remote Desktop Screen



Cybersecurity Requirements at BNL: Perimeter Defense



Cybersecurity Requirements at BNL: Ways for Remote Access

- Employees: VPN, ssh gateway
- Users: ssh gateway only
- Outside of BNL:
  - ssh to ssh gateway (linux server)
  - ssh from ssh gateway to the beamline machine

Remote Operations With NX: Through Ssh Gateway: Ssh Tunneling

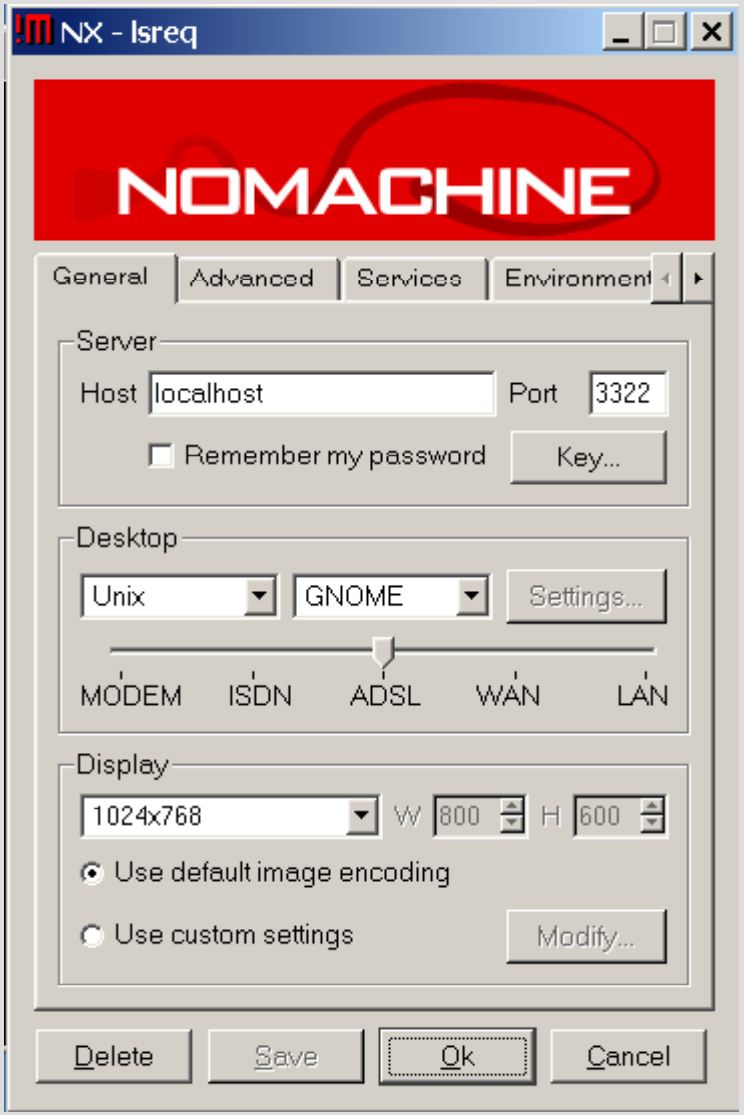
- Ssh tunneling
- Procedures:
  - Unix: ssh -L localport:remotehost:ssh_port# username@ssh_gateway
  - Windows: Putty, similar configuration
- Now to ssh to the remote host can be achieved by

  ssh localhost -p localport -l username
- With ssh tunneling, configure nxclient to use localhost

Remote Operations with NX: Putting It Together

- First set up ssh tunnel:
  - Example:
    ssh -L 3322:lsx21pc.nsls.bnl.gov:22 zyin@ssh.bnl.gov
    (leave the terminal open)
  - Windows: configure Putty or other ssh clients
- Next configure NoMachine Client, to use host “localhost” and port 3322

Remote Operations with NX:
Putting together



- Create ssh tunnel:
  remote host port 22 map to localhost: 3322 through ssh gateway,
  ssh -L 3322:lsx21pc.nsls.bnl.gov:22 zyin@ssh.bnl.gov
- Leave the terminal open
- Configure NoMachine NX client

  localhost port 3322

Remote Operations with NX: Live Demo

- Remote login to my office, or a beamline
- Checking with webcam locally connected (private network)
- Move some motors, check scalers
- Run some other applications

Concluding Remarks

- Secure (all traffic through ssh)
- Fast response
- Generic solution: Configure, no programming
- Open source server, free downloadable multi-platform clients (Windows, Mac, Linux)
- Almost all x-windows programs run fine
- Problems:
  - application specific fonts: set up font servers
  - use blank screensaver (to reduce resource usage)
- Linux hosts: straight forward

  Other Unix flavors: setup a Linux server, as a “stepping stone”

Acknowledgement

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