Brookhaven National Laboratory
VoIP Telephone System Deployment

Lessons Learned and Handy Tips

Scott Bradley
bradley@bnl.gov
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I know the way through the minefield, step exactly where I do!
Executive Summary

- Private Branch Exchanges (PBX’s) Using Time Division Multiplexing (TDM) and Disparate Telephone Network Infrastructure are Obsolete, and Voice over IP (VoIP) Telephony is Driving TDM Technology From the Marketplace
- Replacing Legacy TDM PBX’s With VoIP Technology Requires Fundamental Changes to Management of Cabling Infrastructure, Network Operations, System Maintenance & Admin Support
- *If you haven’t replaced your PBX in the past 10 years, you will be soon*
Purpose of This Presentation

- To Share BNL’s Experience to Date with the Planning, Procurement & Deployment of a Replacement VoIP Telephone System

- Like Bruce Lee Says, “Absorb What is Useful”
Format for Presentation

- Background
- Management of Management
- RFP Development/Procurement Process
- Implementation
Background
OVERVIEW of BNL CAMPUS
GEOGRAPHIC ENVIRONMENT

Department of Energy Owned Space
BROOKHAVEN NATIONAL LABORATORY
MANAGES 348 BUILDINGS ON 5,265 ACRES
(8.23 sq. mi.)

- Scientific Facilities
- Administrative Buildings
  - Office
  - Day Care Center
  - Conference Center
  - Clinic
- Residential
  - Apartments
  - Dormitories
- Major Computer Centers
- Emergency Operations
  - Police Department
  - Fire Department
  - Emergency Operations Center
- United States Post Office
- Teachers Federal Credit Union
- Upton Gas Station
- National Weather Station
- NASA Radiological
- Vendor Trailer(s)
- New Construction – 4 New Buildings
NEAR & LONG TERM REQUIREMENTS

BNL Site Core 2018

1. INTERDISCIPLINARY SCIENCE PH I
2. RENOVATE SCIENCE LABS PH II
3. INTERDISCIPLINARY SCIENCE PH II
4. SUPPORT SHOPS COMPLEX
5. UTILITIES IMPROVEMENT PROJECT (NOT SHOWN)
6. CENTRAL COMPUTING BUILDING
7. RENOVATE SCIENCE LABS III

A. NSLS-II
B. MATERIALS HANDLING
C. MAIN GATE/ENTRY ROAD/ VISITOR CENTER
D. SUPPORT OFFICE BUILDING
E. CENTRAL CHILLED WATER
F. JPSI
G. NSLS-II HOUSING

KEY

- Refurbishments-SLI IGPP
- DMR
- New Buildings-
- NSLS Buildings & Additions
- IGPP
- New Buildings-NY State
- New Buildings-Program Funded
- New Buildings-Alt. Funded

Brookhaven Science Associates
Unfortunately...

- BNL’s Aging Telephone System & Infrastructure Could Not Support These Plans
  - Legacy Siemens PBX Could Not Be Expanded to Support
- BNL Was a WW-I Army Base (really)
- Aging Infrastructure
  - Circa 1980, 26 Gauge Copper
  - Older Buildings Still Wired with Cat 3
BNL Cable Plant

“It Is What It Is”….

No Changes to Existing Cable Plant Will be Made in Support of the Telephone System Replacement

- [The Good News Is] 87% of BNL Population in 31 Buildings, All Connected by Fiber and Wired Internally With Cat5 or Better
- Remaining Buildings Connected by Copper, Some Cat3 Internal Wiring.
- Individual Building Telephone System Design Planned on a Case by Case Basis
OPERATIONAL CONSTRAINTS FOR NSLS-II

Cable Plant Infrastructure

- Underground conduit & cable infrastructure was **non-existent** in the footprint growth area for NSLS-II

Telephone Switch Node 5

- **AT CAPACITY, COULD NOT SUPPORT NSLS-II**
- **ANTIQUATED SIEMENS EQUIPMENT COULD NOT BE UPGRADED OR REPLACED**
Therefore…

● In Order to Support the Opening of NSLS-II in 2012, the BNL Telephone System Had to be Replaced

● Alternatives Analysis Ruled Out Stand-Alone System for NSLS-II, or Hosted Service
After Studying VoIP Implementations Gone Bad…

- In Order to Ensure Reliable VoIP Telephony, the Entire BNL Network Is Being Upgraded as a Supporting Project (~$3M)
  - PoE, QoS Capable Switches
  - UPS’s To Be Upgraded To Provide At Least 2 Hours Backup Power
  - Selling Point Was That We Upgrade >20% of Our Local Area Network Annually as a Matter of Course (Described Further a Few Slides From Now)
Handy Tips

- Your Existing Telephone System Will No Longer Be Expandable/Supported At Some Time in the Future
  - Planning Methodically Now vs. Crisis Management Later

- Detailed and Accurate Documentation of Voice & Data Networks, Underground Cable Plant Critically Important

- [Stomping Feet] Understand Future Construction/Expansion Plans For Your Site
Management of Management
What Needed to be Sold

- Rough Order of Magnitude Cost Estimate to Procure New Telephone System: $7M-$10M
- Cost of Complete Network Upgrade to Support VoIP: ~$3M
- Must Also Estimate Cost of Facilities Support (e.g. Electrical)
Concurrent Efforts:

- Lab-Wide Acquisition Committee Formed
  - Chartered With Formulating Acquisition Plan for Site-Wide Telephone System Replacement (SWTSR)
  - Senior Representatives From ITD, Facilities & Operations, Procurement, Budget Office, NSLS-II & ISB-I PMO

- Staffing Through BNL Policy Council to Obtain Approval for Procurement
  - Initial Sticker Shock, But Business Case Was Made
The Stages of Grief

- Denial
- Anger
- Bargaining
- Depression
- Acceptance
It’s Only Money…

- Cost of Network Upgrade to Make it VoIP Capable Estimated at $3M
  - 4 Year Upgrade Plan Already Underway
- Cost of New System Unknown, However Estimated at $5M-$7M
- Associated Labor Costs
- FY-10 Desktop Rate Raised to $46 From Previous Rate of $31 (ouch)

…and it got more painful…
But Here Are Some Selling Points…
Benefits of Network Upgrade

- Eliminates need to maintain a separate, stand-alone network to support telephone system only
  - Enhances management and maintenance maintenance efficiency
- 1Gbps connectivity to every network jack on campus
  - Greatly enhanced ability to support science & high bandwidth applications
- New UPS systems provide a minimum of 2 hours backup power to every network switch
  - Network reliability to the desktop improved by an order of magnitude
- Entire network can provide Quality of Service (QoS) capabilities to every network jack on campus
  - Users can now prioritize delivery of critical data
General Benefits of Cisco Unity IP Telephony

- Consolidation of two physically separate infrastructures for data and voice offers opportunities to merge and improve the utility of network equipment and manage the network more efficiently.
- Reductions in the cost of “moves, adds, and changes” - phones can be moved with the user and re-connected to a network jack in the new location. The user’s extension, features and service will follow them automatically.
- Cisco Unified Communications applications are now possible with VoIP and can produce productivity enhancements and potential cost savings:
  - Increase in accessibility reduces time wasted trying to reach people.
  - Managing email and voice messages from one inbox reduces time to process all messages.
General Benefits of Cisco Unity IP Telephony (cont’d)

- Mobile users will make the most use of the variety of IP telephony offerings including,
  - Soft phones, which turn your laptop into your office phone when on the road or at home
  - Cellular connectivity which provides the ability for your cell phone to appear as your office phone to callers (no more need to provide multiple numbers)
- Convergence of Voice and Data Networks also enable advances in Video Conferencing using desktop and laptop computers, further reducing travel costs.
- More efficient use of PSTN facilities and voice connectivity to other National Lab sites using SIP Trunking (Signaling)
New Capabilities Provided by Cisco Unified Communications Capabilities

- Meeting Place Audio/Video/Web conferencing – robust capabilities to integrate previously stand-alone H.323 meeting room/desktop video teleconferences, audio teleconferences, web-based collaborative tools
- Integrated Messaging – The ability to retrieve voice messages using your email client. Allows users to check voicemail without having to dial into BNL
- Audio Conferencing – Users can setup audio conferences on the fly without any assistance from the help desk, password protected, and can be recorded for playback later
New Capabilities Provided by Cisco Unified Communications Capabilities (cont’d)

- FAX server – Enables centralized fax services for the BNL campus. This eliminates the need for FAX lines in offices. Users can send and receive FAX’s using email, and their existing phone number
- Single number Reach - Ability to contact someone without having to know where they are
- Call hand-off - Users can hand off a call from their desk phone to their cell and in the opposite direction as well without interrupting the call
New Capabilities Provided by Cisco Unified Communications Capabilities (cont’d)

- Soft phone - Users can use their PC as they would their desktop phone. They can also do this from anywhere in the world using a VPN connection. Available for both Windows and MAC.
- Cellular communications – Mobile users can place and receive calls as if they were on their BNL desktop phone, without giving out their cell number.
- Moves/Adds/Changes – Users can simply plug their phone into a network jack anywhere on campus with their new location being tracked.
New Capabilities Provided by Cisco Unified Communications Capabilities (cont’d)

- Presence – Ability for users to know the status of coworker’s availability
- E911 – 911 location information can be provided to BNL security for every telephone on campus
- XML based phones – Offers the ability to customize XML-based services to provide users with access to information like employee directories and web based content
Handy Tips

- Know When It Will Be Necessary to Replace Your Phone System, Advertise Widely Well in Advance
- Have Alternatives Analysis at the Ready
- Identify Key Stakeholders Across the Site & Engage Them Early
- Understand Funding Model: Desktop Rate/Chargeback? Overhead?
  - Lease to Own vs. Outright Purchase
  - Remember (if you didn’t know already), DOE Doesn’t “Finance” Anything
- GET YOUR DOE SITE OFFICE INVOLVED FROM THE START
  - Procurements >$5M Require DOE Approval
RFP Development/Procurement Process
Scope Definition

- Not Only What It Is You Want To Buy, But:
  - Level of Maintenance Support
  - Dedicated Vendor PM, Engineer?
  - Manpower for Deployment: Station Reviews? Installation?
  - Is Supporting Work on Data Network/Cable Plant Within the Scope of the SOW?
  - [Stomping Feet Here] Obtain Official Determination That This Is An IT vs. “Construction” Project (why, you may ask?)
Scope Definition (cont’d)

- DOE Order 413.3B
  - IT Projects are *Not* Subject to 413.3B

  *However*

- Supporting Cabling Work Requires a Davis-Bacon Determination
RFP Development

- BNL Crafted a Requirements Based SOW
  - Full-Time Consultant Engaged to Assist
  - Defined Required Capabilities
  - Defined *Desired* UC Capabilities (the options package)
- *Best Value* Award, Evaluating:
  - Compliance with SOW (60%)
    - Interoperability With Legacy Siemens System
  - Project Management/Implementation Plan (20%)
  - QA (10%)
  - Safety Plan (10%)
Vendor Engagements

- Vendor Expression of Interest Meeting Held 3/09
  - Described Scope of Work, Defined Required Vendor Qualifications
- PEP Travelled to Siemens, Avaya, Cisco Demo Sites for Presentations on Their VoIP/UC Offerings
- Q&A Session After Publication of RFP
  - Q&A Transcribed and Published on SWTSR Procurement Website
[a few of the] Major Engineering Challenges That Needed to be Addressed in SOW

- Existing Siemens TDM PBX Must Be Integrated With New VoIP Technology To Support Phase-In of New Technology Over a Four Year Period (in concert with network upgrade schedule)
- Legacy Telephone Network Must Be Integrated With LAN To Support Telephones Where No Data Drop Exists
- Peripheral Systems (Voice Mail, Billing, IVR) Must Be Integrated Into Environment Running Both(!) Telephone Systems in Parallel
- Older Copper Cabling May Not Support All VoIP Functionality In Some Buildings
Seamless Interoperability Over 4 Year Transition Period an Absolute Requirement
Proposal Evaluation/Vendor Selection

- Procurement Evaluation Panel (PEP) Formed
  - Chaired by Procurement, Reps from ITD, QA, Science
- (9) Bids Received From Vendors Proposing Siemens (Incumbent), Avaya, Cisco Solutions
- Bids Evaluated/Scored Individually IAW Evaluation Criteria, Then Normalized as a Group
Proposal Evaluation/Vendor Selection (cont’d)

- Of the (9) Proposals Evaluated, The Top Three Were All Cisco*
  
  *Evaluation at BNL Using BNL Evaluation Criteria; Results May Vary

- **Best Value** Award Was Easy, As the Top Vendor Technically Also Had the Best Pricing (how often does that happen?)
  
  …but this was one of the few things that went easily…
Proposal Evaluation/Vendor Selection (cont’d)

- Obtaining DOE Approval to Award Contract Took 5 Months (not to mention the 6 months it took to obtain DOE approval to publish the RFP)
- Contract Awarded 1 May 2011, 2 ½ Years After Creation of Lab-Wide Procurement Committee
Handy Tips

- In Retrospect It Would Have Been Better to Decide on Which Vendor Solution to Purchase (Siemens, Cisco, Avaya), to Make Apples to Apples Comparisons Easier.
  - RFI Before RFP to Help Make That Decision?
- Importance of Understanding Vendor Integration & Deployment Strategy Cannot Be Overstated: Ask Vendors to Demonstrate Specific Knowledge & Experience Integrating With Your Specific Legacy Platform
- Ensure Licensing Requirements for UC Capabilities are Clearly Understood (Most Notably Meeting Place)
- Keep Supporting Cabling Work Out of SOW and Do It Yourself With Existing Resources (or live the Davis-Bacon nightmare; you decide)
- Get Consensus Early On That 413.3B Does Not Apply (unless you enjoy writing OMB-300’s)
- Have We Mentioned to Engage Your DOE Site Office From the Start?
Implementation
“IT Projects are Now so Big, and They Touch so Many Aspects of an Organization, That They Pose a Singular New Risk.”

- Harvard Business Review Examined 1,471 IT Projects, Comparing Their Budgets and Estimated Performance Benefits With the Actual Costs and Results:
  - Average Cost Overrun of 27%
  - One in Six Projects Had a Cost Overrun of >200%, and Schedule Overrun of >70%
Project Methodology

- Cross-Functional Implementation Team Stood Up
- Detailed Project Plan/Schedule
- Although Not a 413.B Project, Earned Value (EV) Being Reported Monthly
- Training (IT Staff, User Community) Major Consideration
- Formal Communication Plan Created With Public Affairs Office
Project Staffing

- Project Director
- **Project Manager (Professional PM From BNL PMO)**
- Telecom Lead
- Network Lead
- Work Control Coordinator
- Safety Rep
- QA Rep
- Procurement Rep
- BlueWater (Vendor) Project Manager
- BlueWater Technical Lead
Earned Value Reporting

### Earned Value Reporting

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### FY 2012 Project Performance Chart (Cumulative)

### FY 2012 Cost & Schedule Performance Indices (Cumulative)

**BCWP** = Budgeted Cost Work Scheduled or Planned Value (PV)

**BCWS** = Budgeted Cost Work Performed or Earned Value (EV)

**ACWP** = Actual Cost of Work Performed or Actual Cost (AC)
Handy Tips

- Professional PM from the BNL PMO Has Been Vital
- Deployment Plans Will Change; Project Plan Must be Flexible
- Single POC to Manage Facilities Support Requirements
- Ensure Deployment Plans are Explained Well and Often to the User Community
- Ensure Training Plan for User Community is Well Thought Out
- Integration of New & Legacy Telephone Systems Ain’t Easy
- If You Charge Back for Telecom Services, Cost Tracking/Budget Projections Must be Provided to Your Budget Office Continually
QUESTIONS?