FY’14 NETWORK PLANNING TASK FORCE

Final Rate Setting Meeting

Michael Palladino
October 21, 2013
Agenda

- Review of FY’14 NPTF topics discussed
- Financial process deployed
- Operating efficiencies/client impact
- Service enhancements/client value
- Review of new initiatives for FY’15
- FY’15 Central Infrastructure Bundle monies requested
- FY’15 proposed rates for other services
- Next steps
Purpose of Today’s Meeting

• To review FY’14 NPTF strategies and projects discussed
• To seek budget approval for new Central Infrastructure Bundle initiatives
• To discuss other N&T rate changes for FY’15
• To discuss some initiatives on the horizon
• To determine next steps
FY’14 NPTF Topics Discussed

- NPTF primer (Mike)
- Review of FY’13 progress and FY’14 NPTF funded initiatives
- Security strategy (Josh)
- Traditional and PennNet Phone update (Mike)
- Next Generation PennNet (Mike)
- Central Active Directory (Shumon)
- Project Portland: DHCP, DNS, NTP upgrades (Shumon)
- Email and Collaboration at Penn: A Cross-Campus Team Approach (Deke)
FY’14 NPTF Topics Discussed (Continued)

• Central Infrastructure Bundle funding model team report (Joe)
• Penn+Box update (Criss)
• Network segmentation (Deke)
• Wireless strategy (Mark)
  • eduroam
  • ISP guest wireless alternatives
  • Internet of Things wireless network
• IP address management alternatives (Mark)
Annual Financial Process

• We do a lines of business (LOB) analysis yearly
• We look at every service to determine the total projected cost and total projected revenue
• We forecast the number of customers for each service & divide by 12 to get the monthly unit cost
• We do this for 60 services
• There are 50+ subservices that feed into the 60
• For instance, DHCP, DNS and NTP are subservices of the LOB called Infrastructure Software Services, which is a component of the Central Infrastructure Bundle
Annual Financial Process (Continued)

• All services “on their own legs”

• No or minimal cross-subsidies
  • Transparent cross-subsidies have been useful in the past, e.g. Next Generation PennNet and NAPs paid in large part by the telephony surplus
  • Have a slight margin on services to fuel R&D, innovation and next generation services

• N&T total projected revenue (minus MAGPI) will be about $24M for FY’15, down from $24.3M in FY’14
FY’15 N&T Total Revenue Sources

- GENERAL FEE (3%)
- TELECOM (27%)
- CENTRAL SERVICE FEES (31%)
- INSTALLS/SERVICE AGREEMENTS (8%)
- PORTS (10%)
- WIRELESS (5%)
- MAGPI/MISC. (7%)
- EMAIL /WEB (6%)
FY’14 Operating Efficiencies

- Strategic efforts to keep rates low while greatly enhancing capacity
  - Continued server virtualization efforts
  - Continued strong negotiations with all vendors, especially on equipment purchases
  - Extending depreciation schedules on equipment
    - Wireless moved from 4 to 5 years for FY’15
  - Selective use of cloud solutions (Akamai, Box) and blended workforce (ACD, analog telephony, Operator Services)
  - Continued efforts to keep headcount (staff and contractors) level -- despite sizable increases in ports, IPs, APs and services over the past 10 years
Internet Growth at Penn

PennNet ISP Bandwidth Capacity

Gbps

Wireless Access Point Growth

AP Counts


AP Counts
Wireless Growth

AirPennNet Current Device/User Trending up to 1.87

Guest User slightly down, Device/User Trending up to 1.53

Total wireless devices trending upward FY’14

After sharp peak in 2011, we show average of 30% growth in device counts year over year
Client Impact of Operating Efficiencies

- PennNet Phone and telephony audits to save clients $2M annually (FY’09 versus FY’15 charges)
  - Annual administrative bills decreasing from $8.3M to $6.8M
  - Students bills decreased from $500k to $0
  - PennNet Phone savings about $300k for FY’15
- Port rate reductions $176k in FY’15
  - 1000 Mbps $7.00 to $4.75/month
  - 6500 ports X 12 months X $2.25/month = $176k
FY’14 Service Enhancements

- 10 Gbps in-building backbones
- 10 Gbps closet electronics
- 10 Gbps building connections to core
- 100 Gbps core router deployment
- 100 Gbps external router deployment 3Q FY’14
- IPv6 continued deployments
- New DHCP, DNS and NTP
- New Radius and Kerberos infrastructure 4Q FY’14
Service Enhancements: Client Value

• Strategic investments in campus backbone and external connectivity have enabled higher speed ports at decreased costs
• Same charge of $4.75 for 10/100/1000 Mbps ports in FY’15
• No additional monthly charge for vLANs or POE (Power over Ethernet)
  • Since building backbone upgrades and closet switch upgrades are necessary for ubiquitous 1Gbps port connectivity, we need to wait until FY’16 to begin FREE 100 Mbps to 1000 Mbps conversions
  • While we have received a few requests for 10 Gbps connections, we are hesitant to offer these connections because one 10 Gbps port can consume a building’s entire capacity
  • In lieu of 10 Gbps in-band connectivity, we suggest using out-of-band or direct fiber connections
  • However, we can offer 10 Gbps ports on a very limited basis (since we no high density 10Gig switches) for $80/month
• Unused ports, we will have reports in 3Q FY’14
Service Enhancements: Client Value

- Internet bandwidth on three 10 Gbps interfaces that are all scalable (iOS release)
- Services for researchers in FY’14
  - Internet2 basic connectivity 1 Gbps
  - Internet2 10 Gbps waves worldwide for collaborations (NDDI, DYNES)
- Services for researchers in FY’15
  - Internet2 basic connectivity 100 Gbps
  - Internet2 100 Gbps waves worldwide for collaborations
  - 20 Gbps free Internet peering to major vendors will help keep Internet costs level for several years
  - All of this for virtually no increase in cost over FY’14 charges
  - Pending NSF grant award, also Science DMZ
FY’14 Service Enhancements

• **Two-factor Authentication**
  - Piloting two-factor service using Google Authenticator and CoSign for individual users who opt in, including infrastructure for provisioning and management of tokens

• **Network Segmentation**
  - Deke will be running a campus team to investigate alternative network topologies and segmentation approaches that may help to enable separable security policies and enforcement approaches
  - He is seeking volunteers
Service Enhancements: Client Value

• Wireless
  • Provides secure, scalable, cost-effective wireless infrastructure to meet the mobility needs and expectations of the Penn community
  • 16% increased capacity in wireless supports academic mission
    • Enables integration of portable devices, specialized applications and online content into the classroom curriculum
    • Facilitates digital learning by allowing students to access web-based course materials from any campus location
  • XpressConnect continues to enhance onboarding experience, saving thousands of support hours annually
  • Device network in College Houses enriches student residential life by enabling non-authenticating wireless devices (Nook, Roku, Xbox etc.) to access the Internet
Service Enhancements: Client Value

• **AirPennNet**
  • The next generation of wireless is called 802.11AC
  • It will provide 1Gbps of capacity per connected device
  • The standards are not yet set, and the mobile clients are far from pervasive
  • We are suggesting that, in most instances, Penn can wait until FY’16 to upgrade
  • We can extend the wireless depreciation from 4 to 5 years
  • Unfortunately, to achieve the higher speeds from AC wireless, a second wire must be pulled to our existing 3600 access points
  • This project will cost about $1M
  • With a 10 year depreciation on the wire pull and by not charging for POE for wireless and extending the AP depreciation from 4 to 5 years, we can hold the AP rate flat (We are also assuming that the NG APs -- when bought in bulk -- will cost about the same as the existing ones)
NPTF Initiatives Approved for FY’14

• We will continue to give updates on these topics at ITR, SUG, NPTF, etc.
  • Penn+Box Storage & Collaboration
  • Enterprise InCommon Certificate Service
  • Enterprise Social Networking
  • Intrusion Detection System
  • SafeDNS
FY’14 CSF Bundle of Services

- Campus Backbone Infrastructure
- Internet and Internet2 access
- Rate limits on ResNet external
- IPv6, Multicast, and Advanced Networking
- Public Wireless Subsidy
- Cap on billable wireless IPs
- NAP Operations/Fiber and Cable Management
- NOC Services and Network Management
- Penn's Main Web and Central Pages
- Classlists and SMTP Mail Relay
- University Calendar Service
- Infrastructure Software Services
  - DNS, DHCP, NTP
  - Penn+Box Storage & Collaboration-
  - Enterprise InCommon Certificate Svc-
  - Enterprise Social Networking-
- Security/ID Management
- Kerberos, KITE, RADIUS
- Penn WebLogin (CoSign and Shibboleth)
- The InCommon Federation
- Authorization (Penn Groups)
- PennNames and Penn Community Services
- Wireless Authentication & Support
- NetReg
- Enhanced AirPennNet Guest Services
- DNSSEC
- Vulnerability Scanning
- Online Directory and LDAP access
- Security Tools, Education, and Response
- PennKey School Support
- Two-factor authentication pilot
- XpressConnect
- Intrusion Detection System-
- SafeDNS-
NPTF Initiatives for FY’15

• RADIUS TLS Infrastructure to support
  • eduroam
  • Internet of Things wireless network

• Network address translation

• AirPennNet-Guest wireless alternatives
  • Vendor Front End (dropped too expensive)
  • ISP Direct Connect
Internet of Things & eduroam Costs
(RADIUS TLS Infrastructure)

<table>
<thead>
<tr>
<th>RADIUS Infrastructure</th>
<th>Vendor</th>
<th>ISC Labor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Time</td>
<td>$75,000</td>
<td>$5,000</td>
<td>$80,000</td>
</tr>
<tr>
<td>Ongoing</td>
<td>$32,000</td>
<td>$4,000</td>
<td>$36,000</td>
</tr>
</tbody>
</table>

- Service enhancement provides authenticated wireless access for Internet of Things devices using digital certificates
- Service enhancement allows for federated user-based authentication to eduroam wireless network
**IPv4 Conservation**

- Use private or IPv6 addresses for infrastructure devices
  - PennNet Phone (18,232 addresses)
  - Routers, Switches, and Wireless APs (10,933 addresses)
    - Not all devices can/should be renumbered
- Bundle Wireless AP groups to pool vLANs
  - Increased efficiency of existing IP ranges
    - Larger subnets are difficult to find
    - Using secondary networks breaks IP mobility
- Potential gains from NAT or ISP models:
  - AirPennNet-Guest (17,167 addresses)
  - AirPennNet-Device (2,097 addresses)
  - Wired GreekNet/ResNet (13,408 addresses)
### IPv4 Address Futures (without intervention)

<table>
<thead>
<tr>
<th>Year</th>
<th>AirPennNet Size (30% Growth)</th>
<th>Surplus or Shortage of Available IPs</th>
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</thead>
<tbody>
<tr>
<td>Now</td>
<td>44390</td>
<td>14199</td>
</tr>
<tr>
<td>2014</td>
<td>57707</td>
<td>-882</td>
</tr>
<tr>
<td>2015</td>
<td>75019</td>
<td>-18194</td>
</tr>
<tr>
<td>2016</td>
<td>97525</td>
<td>-40700</td>
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<td>2017</td>
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<td>-69957</td>
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<td>2018</td>
<td>164817</td>
<td>-107992</td>
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</table>
## Network Address Translation

<table>
<thead>
<tr>
<th>NAT Service</th>
<th>Vendor</th>
<th>ISC Labor</th>
<th>Network Infrastructure</th>
<th>Session Logging</th>
<th>Total</th>
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</thead>
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<tr>
<td>One-Time</td>
<td>$69,000</td>
<td>$12,000</td>
<td>$2,000</td>
<td>$46,000</td>
<td>$129,000</td>
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<tr>
<td>Ongoing</td>
<td>$14,000</td>
<td>$8,000</td>
<td></td>
<td>$15,000</td>
<td>$37,000</td>
</tr>
</tbody>
</table>

- Service enhancement allows for preservation of IPv4 address space
- Logging enhancements are required to determine timestamp and translation of device RFC1918 addresses, MAC addresses to routable IP address
## Wireless Costs (AirPennNet-Guest Alternative)

<table>
<thead>
<tr>
<th>ISP Direct Connect</th>
<th>Vendor (ISP)</th>
<th>ISC Labor</th>
<th>Network Infrastructure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Time</td>
<td>$5,000</td>
<td>$5,000</td>
<td>$24,000</td>
<td>$34,000</td>
</tr>
<tr>
<td>Ongoing</td>
<td>$48,000</td>
<td>$4,000</td>
<td></td>
<td>$52,000</td>
</tr>
</tbody>
</table>

- Service enhancement provides ease of access for guest wireless access by providing separate network link to a local ISP – Estimates based on 250MB
- Reduces/eliminates Penn’s DMCA, RIAA responses
- ISP provides Web Portal, DNS, DHCP, NAT service & Logging, and Helpdesk support
- Could save 17,000 IP addresses
FY’14 CSF Bundle of Services

- Campus Backbone Infrastructure
- Internet and Internet2 access
- Rate limits on ResNet external
- IPv6, Multicast, and Advanced Networking
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- University Calendar Service
- Infrastructure Software Services
  - DNS, DHCP, NTP
  - Penn+Box Storage & Collaboration - New!
  - Enterprise InCommon Certificate Svc - New!
  - Enterprise Social Networking - New!
- Security/ID Management
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- Two-factor authentication pilot
- XpressConnect
- Intrusion Detection System - New!
- SafeDNS - New!
FY'15 Central Infrastructure Bundle Breakdown (Baseline)

- **CAMPUS BACKBONE (30%)**
- **INTERNET/INTERNET2 (18.4%)**
- **NOC/NETWORK MANAGEMENT (7.0%)**
- **IDENTITY MANAGEMENT/SECURITY (37.7%)**
- **MAIL RELAY, LISTSERV, DIRECTORY (NISC) (1.4%)**
- **WIRELESS (1.2%)**
- **BOX (2.6%)**
- **ENTERPRISE SOCIAL NETWORK (0.3%)**
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<th><strong>FY’15 CSF BASELINE TOTAL COSTS</strong></th>
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<td><strong>FY’14 TOTAL CSF REQUEST APPROVED</strong></td>
<td>$ 7,877,445</td>
</tr>
<tr>
<td><strong>% INCREASE</strong></td>
<td>0.36%</td>
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<td>FY'15 PROJECTED CSF TOTAL COSTS (MAXIMUM)</td>
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<td>INTERNET OF THINGS (NEW)</td>
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<td>EDUROAM (NEW)</td>
<td>$ 58,000</td>
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<td>NETWORK ADDRESS TRANSLATION (NEW)</td>
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<td>ISP GUEST NETWORK (NEW-PILOT)</td>
<td>$ 0</td>
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<td>FY'15 MAXIMUM CSF REQUEST</td>
<td>$ 8,187,836</td>
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<td>3.6%</td>
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CSF RATE CHANGE FOR FY’15

• NPTF members voted yes to the four initiatives below for FY’15
  • Internet of Things $58k
  • eduroam $58,000
  • Network address translations infrastructure $166,000
  • ISP wireless guess network pilot $0
• Mike Palladino agreed to spread the one-time monies of $209k over two years
• This resulted in a 2.25% CSF charge for FY’15
• See page 34 for the FY’15 new initiatives with CSF monies requested with $104,500 one-time deferral until FY’16
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<td>FY’15 CSF REQUEST WITH ONE-TIME MONIES OF $104,500 DEFERRED UNTIL FY’16</td>
<td>$8,083,336</td>
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<tr>
<td>% INCREASE</td>
<td>2.25%</td>
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## FY’15 Proposed Monthly Rates

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<tr>
<th>SERVICE</th>
<th>FY '14 RATE</th>
<th>FY '15 RATE</th>
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<tr>
<td>NETWORK</td>
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</tr>
<tr>
<td>10baseT port charge</td>
<td>$4.75</td>
<td>$4.75</td>
</tr>
<tr>
<td>100baseT port charge</td>
<td>$4.75</td>
<td>$4.75</td>
</tr>
<tr>
<td>1000baseT port charge</td>
<td>$7.00</td>
<td>$4.75</td>
</tr>
<tr>
<td>Wireless Access Point (without port)</td>
<td>$25.75</td>
<td>$25.75</td>
</tr>
<tr>
<td>PHONES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional services (lines, set, usage, long distance)</td>
<td>See next page</td>
<td>See next page</td>
</tr>
<tr>
<td>Phone (PennNet Phone)</td>
<td>See next page</td>
<td>No increase</td>
</tr>
<tr>
<td>VIDEO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penn Video Network</td>
<td>$20.50</td>
<td>$21.50</td>
</tr>
<tr>
<td>Video Production, Conferencing, Streaming</td>
<td>No increase</td>
<td>No increase</td>
</tr>
<tr>
<td>HOURLY RATES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Project Managements /Consulting</td>
<td>No increase</td>
<td>No increase</td>
</tr>
<tr>
<td>Service</td>
<td>Traditional Phone</td>
<td>PennNet Phone</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Centrex line/VoIP line</td>
<td>$18.00</td>
<td>$16.50</td>
</tr>
<tr>
<td>Phone set maintenance</td>
<td>10% INCREASE</td>
<td>$3.00</td>
</tr>
<tr>
<td>Voicemail</td>
<td>NOT AVAILABLE</td>
<td>$3.00</td>
</tr>
<tr>
<td>Port</td>
<td>$0</td>
<td>$4.75</td>
</tr>
<tr>
<td>Usage (average)</td>
<td>$6.00</td>
<td>$3.00</td>
</tr>
</tbody>
</table>
FY’15 Telephone Rates

- PennNet Phone rates are the same in FY’15
- For FY’15 we can no longer support free conversions and free supplemental wire pulls if needed
  - During FY’14 these subsides will continue to save clients one-time charges of $115 to $500 per conversion
  - Please put in your requests ASAP for PNP conversions to take advantage of these subsidies
FY’15 Telephone Rates (Continued)

- **Drivers for increasing traditional phones rates**
  - Vendor costs increasing
  - Sets and systems are out of vendor support
  - Legacy conduits and cable are expensive to maintain
  - Legacy contractors are expensive
  - Centrex lines will increase from $16.75/month to $18.00/month
  - Traditional sets and systems will increase in cost by 10%
  - Octel voicemail is out of support this calendar year and will be shut off no later than in 4Q of FY’14
    - Over 750 Octel accounts remain. Please contact service-requests@isc.upenn.edu ASAP to arrange for upgrades to PennNet Phone
FY’15 Telephone Rates (Continued)

• We recognize the need to retain about 3000 analog lines after all other standard lines have been converted to PennNet Phone
  • FAX: ISC/Business Services will offer a cloud-based eFAX service
  • Security lines (desk, corridor, mechanical rooms)
  • ATM machines
  • Elevator phones
  • Emergency phones (Garages, exterior buildings)
  • Security system panels that use telephone lines
  • Copper lines to support R&D in labs (e.g. explosion proof phones)
  • Cordless phones
• We will seek the best rate possible from Verizon (or alternatives)
Other Necessary Rate Changes

- **Email (Zimbra & Exchange)**
  - Need to increase monthly rates to $4.50 from $4.00 and $10.00 from $9.50 respectively to break even in FY’15
  - The base amount of storage per email account on Zimbra and Exchange will be increased from 1GB to 2 GB.
  - Campus-wide email team evaluating needs/options/costs for cloud services

- **ACD**
  - Rate increasing 5%

- **Lists**
  - Rate increasing 5%
Penn+Box for FY’15

• Nearly 10,000 users
• Estimated total project costs
  • Internet2: $116,000
  • ISC support: $90,000
    • LSP support, documentation, vendor and service management, new app review, etc.
• Total $206,000 annually for 100TB of storage
• I announced that there was no charge in FY’14 for supplemental storage over 50G
• NPTF agreed that standard rates should apply for storage of 500 Gig and up
• Supplemental storage rates will be charged starting 1/1/14 and billed monthly
Next Steps

• NPTF makes rate recommendations
• Bring recommendations to CIO
• ISC calculates and finalizes CSF headcount and IP rates and sends them to senior BAs
• ISC Finance Group will provide year-over-year data on total N&T expenses by school/center, comparing FY’13 actual with FY’14 and FY’15 projected in December based on new rates
• Approved rates sent to ABA group and published in *Almanac* in December
Initiatives On the Horizon

- Central Infrastructure Bundle funding model
  - Recommendations made; implementation deferred until FY’16 (new ISC-wide funding model)
- Two-factor authentication service
- Network segmentation
- DAS to improve campus cellular signal
- Upenn.edu address for everyone
Initiatives On the Horizon (Continued)

• Email and collaboration tools cloud solutions and Central Active Directory discussions deferred and are part of school/ISC team

• Funding Plan for Cloud-based email/calendar to cover
  • Integration with Campus IT system
  • User account management/configuration
  • Mail routing
  • E-Discovery management
  • End user and LSP support
NPTF: Is it working?

- Next meeting would be Spring 2014
- Box lunch ("focus group") this calendar year to discuss NPTF process
  - Is this process working?
  - How can it be improved?
- How should we handle initiatives in progress?
  - NPTF meetings
  - Teams reporting back to ITR core or ITR extended group
  - Something else?