May 31, 2007

Technology Infrastructure for Education and Research (TIER)
Aggregated Network Projects for 2006-2007 TIER Funding
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Background:
The Repositioning, now TIER, program (Diagram 1) can be viewed as a natural extension of the UCLA Connected project. Where UCLA Connected was a massive effort to modernize building network infrastructure for over 69 academic buildings at a cost of $49 million, TIER is more about change management in the way we manage networks. Specifically TIER is the consistent application of funding (currently at $2.1 million annually) to projects that meet emerging next generation network criteria, most importantly to:

1) Consolidate independent networks into single building or regional (multi-building) networks, as appropriate.
2) Reduce or eliminate duplicative equipment in multi-tenant buildings.
3) Ensure the appropriate longer-term equipment maintenance— which implies that networks be maintained independent of funding source.
4) Move to shared network management models— which implies that TIER funds are used for service provisioning for consolidated multi-tenant buildings and/or regional networks.
5) Specify and procure equipment such that the equipment can be incorporated into an evolved next generation network model— which implies that TIER funds are used to augment local funds to ensure consistent network standards will provide high performing connectivity and service independent of location, affiliation or local, funding ability.

In a practical way, TIER must also deal with the gaps created by the natural progression of technology and infrastructure that is now manifest for some of the earliest Connected projects, administrative buildings that were not part of the Connected project, and those academic buildings that, for historical reasons no longer relevant, did not get the full benefit of the Connected program.

2006-2007 Aggregated TIER program and projects

In the academic year 2006-2007, OIT partnerships have advanced the TIER program for networking on several fronts:

1) Developed the TIER fund use principles and early network design principles on which to award TIER funding (Appendix 1).
2) Created and resourced the next generation network team to establish detailed design criteria for the UCLA next TIER network (an evolving body of work that is updated on www.ucla.net/wiki).
3) Worked with the campus community to identify projects that demonstrated need and early alignment in the direction of one or more of the next generation design criteria. The projects are 1) the Medical Science Region (Nursing, Public Health, Medical School, and Dentistry), 2) the Broad building, 3) CNSI, 4) Physics and Astronomy, 5) the Kinross building and 6) Murphy Hall.

**Early Adopter Project Rationale for Funding:**

A table for all projects with rationale for TIER funds can be found in Appendix 2. In summary all the projects align with the next generation requirements for standard electronics. In two cases, the Broad and CNSI buildings, under an emergency funding agreement, matched TIER funding has been provided. Additional funds are not required.

Four projects – CNSI, the Kinross building, the Factor Building (School of Medicine and Nursing), and Murphy Hall - concerned multi-tenant buildings. With the exception of the Murphy Hall project, all met the requirement of non-duplicative building equipment, which then led to some type of agreement for outsourced building level provisioning of network services (Kinross) or shared management services between tenants (Factor and CNSI).

Murphy Hall supports nine networks - AIS, Student Accounting, Capital Programs, External Affairs, Chancellor’s Office, Student Affairs, Registrar, Graduate Division, and the College. The plan was to consolidate all networks within an integrated building network under one building manager. Because agreement across all nine Murphy Hall units was not reached for a non-duplicative equipment building and management model and because of the high cost (est. >$3 Million) of infrastructure build-out¹, the Murphy Hall project is not at this time recommended for TIER funds for the 2006-2007 year. Murphy Hall represents the core functions of the UCLA academic business. As it is now configured there will continually be increased costs of management, equipment procurement, cabling adds, moves and changes and different levels of service and performance depending upon affiliation. The building as a whole is not positioned for future network services. For completeness Appendix 3 provides an overview of Murphy Hall costs and options for moving forward.

An extensive technology review was done for the Physics and Astronomy building which included a thorough review of its network (10/100/1000 MB network) due to faculty concerns of possible performance problems for its intra-building network and an insufficient number of high performance ports. Given the nature of the academic work being done (physics and astronomy being widely recognized as disciplines that make heavy use of high-speed networking), a fully configured 10/100/1000 MB network with additional ports is appropriate.

The project collectively called the “Medical Science Region” (Nursing (Factor), School of Medicine (Factor), Dentistry, Public Health, and NPI), provides us an opportunity to understand the change management implications of a multi-tenant building network consolidation and regional service provisioning (through the School of Medicine). At the same time, TIER funds will provide much needed upgrades to end of life equipment for each of the units involved. It should be noted that most of the buildings in the Medical Science Region were the very first to receive Connected funding and as such received only a 50% match². The Dentistry building, for historical but no longer relevant reasons, was not brought up to the standard Connected infrastructure model found in other academic buildings and should be given special consideration. Finally, the NPI building was to be demolished, thus its network infrastructure was not upgraded under Connected. It has now been repurposed to house faculty and its network is substandard and is in need of urgent upgrade.

¹ As was true for other administrative buildings, Murphy Hall was not part of the UCLA Connected project.
² In 2000 UCLA Connected Funds were awarded on as 100% basis.
Program Observations and Next Steps

The UCLA Connected Project also envisioned integrated building networks for multi-tenant buildings. It also sought to achieve equipment and maintenance consistency across campus. While Connected achieved a great deal, the necessary foundational changes in funding and management models were not made to achieve this vision.

The TIER program effort over the past year has largely been to negotiate agreements between willing participants who see the benefit of increased cooperation with potential to consolidate networks within a building or to regionalize in geographical or functionally similar area. The TIER program is largely one of change management with incentives for people to move in cooperative directions and/or to achieve alignment with next generation network directions. These incentives exist in direct and in-direct ways, with TIER funding being the most direct benefit. However, the current funding allocation for TIER is not nearly enough to keep up with the normal upgrade demands (estimated at $6 Million annually), let alone continue as an incentive mechanism.

1. **A funding model that can meet the transition demands of the campus to adopt the next generation network should be the priority in year three of the TIER program.**

Indirectly, units can benefit by having greater skills and abilities available to them through greater cooperation. Equally, the availability of spare equipment is more likely to result through increased collaboration. A common observation is that some units maintain their equipment others do not. There is the potential to achieve decreased maintenance costs through campus agreements, creating an incentive to maintain and sustain high performing and secure networks. In either case because of the importance of maintenance, TIER funds should be given where there is agreement to maintain equipment.

2. **A campus network maintenance plan and program should be the priority in year three for the TIER program.**

As much as UCLA Connected achieved, there remain some buildings (including academic buildings) that have not reached the standard for building infrastructure and/or technology. And as the campus moves towards the provision of voice services through voice over IP (VOIP) there will be increased building infrastructure requirements, across a number of campus buildings, for space, power and air conditioning to accommodate the new equipment.

3. **A clear understanding of the priorities and timeline for network upgrades is critical to moving forward. A campus gap analysis should be part of the next generation design team’s effort for year three of the TIER program.**

The TIER program does not envision one campus centralized network provider. Rather it depends upon a strategy where different network providers emerge and receive TIER funding for services based upon geographic location or function or by other agreements that achieve the same through outsourcing network services.

4. **A common and consistent partnership based memo of understanding and costing model for provisioning services should be the priority in year three of the TIER program.**

Finally, work must continue in the development of the next generation network model. We envision two additional teams being formed – one being an engineering team that can use the higher level design criteria to create standard network specifications and the other being an operational team that studies implications of the new design and creates new operating procedures for how networks are managed and maintained. These
teams should include dedicated central, CTS, AIS and OIT resources as appropriate with job function, in addition to federated campus participation.

5. In 2007-2008 the next generation model – design, operations, and procedures - should be completed before a call for project proposals.

6. In 2007-2008 a formalized process\textsuperscript{3} to apply for TIER funds should be developed.

Given these priorities, it is recommended that in the 2007-2008 academic year of the TIER program, only urgent requests be considered for TIER funding rather than the program taking on more “early adopter” type projects.


\textsuperscript{3} A recommendation from the NGN team is to develop a “grant like” proposal process with peer review.
Diagram 1 – UCLA Network in Phased Implementations

1 - Mainframe

Coaxial Cable into the OAC and AIS Mainframe environments

2 - Local Area Networks (LANs)

IBM partners with UCLA to create the campus backbone and unit managed Local Area networks

Connecting to the internet and within a local area network is achieved but is dependent upon local investment.

3 - Standard building infrastructure

With large ($49M) central investment, academic buildings are brought up to a standard building cabling and hub room model

The consistent application of TIER funds ( $2.1M annually ) to projects that align with the next generation network principles and criteria:
- Shared management
- Visibility to the entire network
- Common tools and richly provisioned services
- Non duplicative equipment in multi-tenant buildings

The TIER program will provide high performing connectivity and service independent of location. affiliation or local funding ability.

4 - Leased fiber to connect distributed unit buildings in the same domain (limited backbone presence)

5 - TIER Regional networks
(Transition state)

6 - TIER Expanded physical backbone
presence with layered services and shared - local, regional and central management. Fully funded campus network ( est $6M annually with the time targeted investment to bring the entire campus to Connected standards )
Appendix 1

WORKING DOCUMENT

TIER Fund Use Principles and Process
FY2006-07

The ITFOC met to provide initial input on the following question:

“What are the considerations that should guide the most effective use of the TIER funds portion of the TIF for campus infrastructure implementation proposals that fall within TIER project objectives?”

Based on the ITFOC input, the following are principles/process statements about how Next Generation Infrastructure for research and education (TIER) funds would be used:

TIER Fund Use Principles/Process

1. The Chancellor has assigned a portion of the Technology Infrastructure Fee (TIF), now being collected, to the TIER Project. The EVC and the Office of Finance and Budget have authority over the fund. Approximately $2.1 million per year is collected. The Office of Finance and Budget will determine the precise amount available for TIER for a given FY.

2. TIER funds will be used to further the goals of the TIER project and the criteria and models (when completed) for the next generation campus IT infrastructure for network, email, data center, and security resources and services.

3. TIER funds should be used to compliment an existing funding base. The corollary is that TIER funds should not be used as replacement funds for lost or reassigned funds in a capital project (as an example). Building upon and existing base, TIER funds should be used to position the project to align with the next generation network criteria and eventual architecture.

4. The allocation of TIER funds should be used as an incentive for units to move towards a campus infrastructure architecture that optimizes for both local and campus needs. The allocation of funds should, however, respect and accommodate the fact that individual units have needs that may be different than the needs of other units. OIT will work with departments to achieve balance for both institutional and local needs.

5. It is understood that the criteria and models for TIER are not deterministic but need to evolve and/or be developed as experiences build. In the short term, the TIER project director along with campus technical teams will develop, refine, evolve and publish criteria to which proposals must adhere. Ultimately, these teams will develop the next generation campus infrastructure model and strategies for implementation.

6. The evolving criteria and models will be vetted through the IT governance process, i.e. CSG, CITI, ITPB and other stakeholders with orchestration and oversight through the ITFOC.

7. The call letter for networking projects should come from the Chancellor’s annual strategic planning and budget process.

8. Funding proposals and needs from individual units will be assimilated by OIT into a FY TIER spending plan. Accordingly, proposals will have to demonstrate that any proposed expenditure is aligned to the goals of the TIER project and align with the next generation network criteria and model (when completed). In developing a FY proposal OIT will consult with the departments involved. When opportunities or urgent requirements are present, OIT will accommodate proposals outside of the FY plan. Funding proposals must also align with the goals of the TIER project and align with the next generation campus network criteria and model (when completed).

9. FY plans, and when appropriate proposals outside the FY plan, will be reviewed by the ITFOC with comments to the ITPB. Comments from the ITPB will be forwarded to the EVC and the Office of Finance
and Budget for consideration. OIT will have the review and endorsement authority of a given FY plan or proposals outside the FY plan. The Office of Finance and Budget will make final decision and release TIER funding.

For FY 06/07, the early criteria for the next generation network model for which proposals for funding must align:

1. Independent networks that move to consolidate networks within a building or within a geographical or functional region should be a priority of the TIER program and funding.\(^4\)

2. Funding must be consistent with the provision of a non-duplicative and/or non-overlapping networking service within a given geographical space. (i.e., TIER funds will not be used to install multiple, overlapping networks in a building when a simpler network structure would suffice).

3. Any department/group for which funding is being provided must commit to being part of the next generation network (NGN) model as it becomes established under the assumption that the unit is not negatively impacted.

4. A network design and configuration must be vetted by the NGN working group and the Campus Network Architect for technical compliance with the expected NGN model (this is an evolving process; standards that are approved in the beginning may not be the final standards six to twelve months later).

5. Adherence of networks to evolving security standards should be auditable by the appropriate security office - currently that responsibility is with the OIT Security Officer and the Applied Security Task Force.

6. All network build-outs or upgrades, independent of funding source, should adhere to the campus network model.

7. Network equipment purchased through TIER funds, should, where appropriate, become available for redistribution. These exchanges should be facilitated to ensure that a local unit is not disadvantaged and that benefits of the exchange accrue to local units and the campus.

8. All TIER funded equipment will be maintained at current (up-to-date with the current manufacturer supported) operating software levels\(^5\) to ensure security and functional requirements are met\(^6\).

9. All TIER funded equipment will provide operational visibility for local, regional and central providers. The TIER project will provide services for network monitoring and diagnostics such that authorized individuals with operational accountability or responsibilities for a UCLA network will have access to information and tools to enable them to diagnose, troubleshoot, and solve network problems across UCLA networks.\(^7\)

10. Independent of funding mechanism, appropriate electrical and air conditioning must be provided for all communication rooms that house any TIER-funded electronic as specified by the manufacturer’s recommendations.

\(^4\) Addition based on recommendations made at the ITFOC Meeting on April 27, 2007.

\(^5\) Revisions based on recommendations made at the ITFOC Meeting on April 27, 2007.

\(^6\) Revisions based on recommendations made at the NGN and CSG meetings in May 2007.

\(^7\) Addition / modifications based on the recommendation at the ITFOC meeting on April 27, 2007, as well as at the Next Generation Network Group meeting on May 16, 2007.
## Appendix 2a)- 2006-2007 ATIER Early Adopter Projects

<table>
<thead>
<tr>
<th>No.</th>
<th>Project</th>
<th>Network Service Provision</th>
<th>TIER Alignment</th>
<th>Other Considerations</th>
</tr>
</thead>
</table>
| 1.0 | Total Medical Science Region | • Shared management (wired and wireless) between participating units – SOM, Dentistry, Nursing and Public Health  
• Regional Provider – David Snow (SOM) | **Multi-tenant building** (Factor) with integrated (non duplicative) equipment  
• Regional management with customized levels of management – from shared management to complete outsourcing to School of Medicine (Public Health)  
• Equipment specifications allows for next generation model | • First collaboration of network service provisioning for multi building across different networks and networks within multi-tenant buildings. |
| 1.1 | Factor-Nursing & SOM | See above | See above | •-funded at 50% for the Connected project. |
| 1.2 | Dentistry | See above | See above | •-funded at 50% for the Connected project.  
• Building communication rooms not built to Connected standards. |
| 1.3 | Public Health | See above | See above | •-funded at 50% for the Connected project.  
• Adopted campus wireless model within the building thus expanding the wireless standard.  
• Wireless equipment paid by CTS. |
| 1.4 | NPI | See above | See above | • Network is seriously out of date for the type or high end research being conducted by faculty. |
| 1.5 | MSRN Wireless | • School of Arts (wired)  
• CTS (wireless) | **Single tenant building**  
• Equipment specifications allows for next generation model | • Extends wireless to School of Medicine.  
• Wireless not funded by CTS. |
| 2.0 | Broad Wireless (committed 2006) | • School of Arts (wired)  
• CTS (wireless) | **Single tenant building**  
• Equipment specifications allows for next generation model | • Adopted campus wireless model within the building thus expanding the wireless standard.  
• Wireless equipment paid by CTS. |
| 3.0 | CNSI Wireless (committed 2006) | • Shared management (wired) between participating units (Life Sciences, Physical Sciences, Crump, IDRE-ATS, Engineering, School of Medicine  
• CTS (wireless)  
• CTS (VOIP) | **Multi-tenant building** with integrated (non duplicative) equipment  
• Shared management model  
• Equipment specifications allows for next generation model |  |
| 4.0 | Physics & Astronomy | • Physics and Astronomy (wired and wireless), in collaboration with campus network architect and ATS. | **Single tenant building**  
• Equipment specifications allows for next generation model. | • Researchers, especially those doing high performance computing with large data sets, have been limited with the network configuration. |
| 5.0 | Kinross | • Outsourced management to CTS. | **Multi-tenant building** with integrated (non duplicative) equipment  
• Central Management  
• Equipment specifications allows for next generation model |  |
## Appendix 2b) Estimated Project Costs (does not include local matching information)

### TIER Early Adopters- Network Upgrade Projects

<table>
<thead>
<tr>
<th>Dept. Costs</th>
<th>Preliminary Estimation of Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006-07</td>
</tr>
<tr>
<td>1.0 Medical Sciences Region⁸</td>
<td></td>
</tr>
<tr>
<td>1.1 Factor Building (Nursing &amp; SOM)⁹</td>
<td>$ 48,121</td>
</tr>
<tr>
<td>1.2 School of Dentistry¹⁰</td>
<td>$ 282,486</td>
</tr>
<tr>
<td>1.3 School of Public Health¹¹</td>
<td>-</td>
</tr>
<tr>
<td>1.4 Neuro-Psychiatric Institute (NPI)¹²</td>
<td>-</td>
</tr>
<tr>
<td>1.5 Wireless Program</td>
<td></td>
</tr>
<tr>
<td>School of Dentistry Factor</td>
<td></td>
</tr>
<tr>
<td>Neuro-Psychiatric Institute (NPI)</td>
<td></td>
</tr>
<tr>
<td>CHS</td>
<td></td>
</tr>
<tr>
<td>2.0 Broad¹³ (Committed, not total costs)</td>
<td>$ 120,000</td>
</tr>
<tr>
<td>3.0 CNSI¹⁴ (Committed, not total costs)</td>
<td>$ 888,000</td>
</tr>
<tr>
<td>4.0 Physics and Astronomy⁷</td>
<td></td>
</tr>
<tr>
<td>5.0 Kinross⁷</td>
<td>$ 315,000</td>
</tr>
</tbody>
</table>

**TOTAL** | **$330,607** | **$1,522,493** | **$2,538,522** | **$2,147,399** | **$1,282,299** | **$7,490,713** | **$7,832,320**

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⁸ Funding options to support the consolidation efforts within this region requires further discussions.

⁹ Multi-tenant building within the CHS complex requires upgrade to their network equipment/electronics, electrical capacity, and some new cable. The $48,121 department cost is for firewall/security features and management tools which would be considered duplicative costs within the NGN/MSRN model.

¹⁰ Two single-tenant buildings within CHS complex with different functional groups – academic and clinical. The academic side requires upgrade to their network equipment/electronics; replacement of cable/conduit; as well reconstruction of space into communication rooms (IDFs/MDFs). The clinical side required upgrade to some of their network equipment/electronics and replacement of some cable to ensure the new radiography system requirements are met. The $282,486 department costs are for the clinical-side upgrade. Infrastructure costs are preliminary estimates at best and don't currently take into consideration additional OSHPD expenses.

¹¹ Single-tenant building within the CHS complex requires upgrades to their network equipment/electronics to support their faculty residing in the building. Replacement of CAT5 cable may be necessary. However, the poor seismic rating of this building requires a cost-benefit analysis of any substantial investment in retrofitting the network infrastructure.

¹² Single-tenant building within the CHS complex requires upgrades to their network equipment/electronics to support their faculty residing in the building. Replacement of CAT5 cable may be necessary. However, the poor seismic rating of this building requires a cost-benefit analysis of any substantial investment in retrofitting the network infrastructure.

¹³ New construction of single tenant building with opportunity to upgrade network equipment/electronics to align with NGN requirements and standards. Commitment of TIER funds has already been reviewed and approved.

¹⁴ New construction of multi-tenant building with opportunity to upgrade network equipment/electronics to align with NGN requirements and standards. Commitment of TIER funds has already been reviewed and approved.
Appendix 3 – Murphy Hall Project

Murphy Hall Project Estimated Costs (does not include local matching information)

The purpose of the Murphy Hall project was to demonstrate the opportunities for savings by moving to a consolidated network environment, while at the same time decreasing management complexity and improving overall network performance and services. The following table summarizes the longer term value of creating an integrated building network.

<table>
<thead>
<tr>
<th>Current Operations</th>
<th>Proposed Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of network switches (complexity)</td>
<td>41</td>
</tr>
<tr>
<td>Number of Murphy Hall hub rooms</td>
<td>16</td>
</tr>
<tr>
<td>Network design consistent with UCLA direction</td>
<td>no</td>
</tr>
<tr>
<td>Network hardware functionality consistent with UCLA direction</td>
<td>some</td>
</tr>
<tr>
<td>Number of switches needing replacement after 9/06 due to end of vendor support</td>
<td>28</td>
</tr>
<tr>
<td>Connections to CTS backbone</td>
<td>10 pair</td>
</tr>
<tr>
<td>Number of staff touching the network</td>
<td>Approx. - eight</td>
</tr>
</tbody>
</table>

Murphy Hall Estimated Costing Options (to bring Murphy Hall up to Connected Standards)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Hub Room Build-out (4)</td>
<td>630,000</td>
<td>$630,000</td>
<td></td>
<td>$20,000</td>
</tr>
<tr>
<td>Pathways (5)</td>
<td>233,000</td>
<td>$233,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiring to Wall plate</td>
<td>880,000</td>
<td>$293,000</td>
<td>587,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Electronics</td>
<td>720,000</td>
<td>reuse available</td>
<td>720,000</td>
<td>$130,000</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$2,463,000</td>
<td>$1,156,000</td>
<td>$1,307,000</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous est. (Asbestos, old wire removal, furniture movement, overtime, etc.)</td>
<td>$500,000</td>
<td>$200,000</td>
<td>$300,000</td>
<td></td>
</tr>
</tbody>
</table>

Total Estimated Non Phased | $2,970,000 | $1,356,000 | $1,607,000 | Est. $350,000 |

Inflation over 3 Years | 15% inflation |

Total Estimated Phased | $3,400,000 |