South American Astronomy Coordination Committee (SAACC) Fall Meeting Report

October 19, 2017, Santiago, Chile

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1. Executive Summary

This report attempts to capture the main updates from the AmLight SAACC Fall Meeting 2017. The meeting gathered participants from several university, organizations and research institutions from USA, Latin America, and Europe. The SAACC Meeting was comprised of two sessions: Science Requirements & Activities Updates and Providers updates.

Science Requirements & Activity Updates session started with welcome remarks and introduction followed by presentations from AURA, NRAO, ALMA, LSST and ended with Open Discussion & Coordination. Providers Updates session started with presentations on AmLight updates and continued with presentations from REUNA, RNP, RedCLARA, ANSP, Internet2 and ended with Open Discussion/Coordination.

2. Introduction

The South American Astronomy Coordination Committee (SAACC) is comprised of representatives from the various astronomy projects who are conducting projects or operating observatories in South America. The initial chair of the SAACC, Dr. R. Chris Smith, director of the Cerro Tololo Inter-American Observatory and head of mission for AURA Observatory in Chile, provides oversight of the Chilean activities of CTIO, Gemini, SOAR, and LSST.

3. Goals and Objectives of the AmLight SAACC Meeting

AmLight ExP builds upon the results of the WHREN-LILA project, Award# OCI-0441095, and the AmLight IRNC project, Award# ACI-0963053. Over the last ten years, these projects successfully supported a cooperative and collaborative consortium among R&E network providers and users in the Western Hemisphere. The success of previous U.S. - Latin American networking activities has led to a ground swell of change for research instruments. Data intensive instruments and data *dependent* instruments are being located in South America. The Large Synoptic Survey Telescope (LSST) is a significant example of a data dependent instrument and has from the beginning been part of the planning for AmLight ExP (NSF award # 1451018). The focus of AmLight ExP is to be an open instrument for collaboration, interconnecting open exchange points, and providing a means to leverage collaborative purchasing and network operation in order to effectively maximize the benefits to all investors, and manage the NSF investment in the context of international partnerships. See Appendix A for the agenda.

4. Activities of the SAACC Meeting Santiago, Chile

The AmLight SAACC Fall meeting took place on October 19, 2017, at the REUNA's offices located at José Domingo Cañas 2819, Ñuñoa, Santiago, Chile from 11:00am to 16:30pm (CLST)

26 attendees participated (9 in person and 27 remotely). See Appendix B for details.
The meeting gathered participants from several universities, organizations and research institutions from USA, Latin America and Europe:

- Academic Network at São Paulo (ANSP), Brazil
- Atacama Large Millimeter/submillimeter Array (ALMA)
- Association of Universities for Research in Astronomy (AURA)
- Brazilian e-science/astronomy virtual institute LINEA
- Brazilian National Research and Educational Network (Rede Nacional de Ensino e Pesquisa - RNP)
- Center for Internet Augmented Research and Assessment (CIARA) at Florida International University (FIU)
- Cornell University
- Energy Sciences Network (ESnet)
- European Southern Observatory (ESO)
- Florida LambdaRail – Florida's Research and Education Network

- Information Science Institute (ISI) at University of Southern California (USC)
- Internet2
- Large Synoptic Survey Telescope (LSST)
- Latin American Advanced Networks Cooperation (Cooperación Latino Americana de Redes Avanzadas-RedCLARA)
- National Center for Supercomputing Applications (NSCA)
- National Radio Astronomy Observatory (NRAO)
- National Science Foundation (NSF)
- National University Network Chile (Red Universitaria Nacional -REUNA)
- University of California San Diego (UCSD)

Video Conference connection via Vydio and Bluejeans app. was offered to all invited participants, which were not able to travel to Santiago, Chile.

4.1 SAACC Participants Updates

The SAACC Meeting was comprised of two sessions: Science Requirements & Activities Updates and Providers updates. See Appendix A for agenda details.

Science Requirements & Activity Updates session started with welcome remarks and introduction from Chris Smith, (SAACC Chair) and Julio Ibarra (AmLight PI) followed by presentations from AURA (Chris Smith), NRAO (David Halstead, Mark Lacy), ALMA (Giorgio Filippi -ESO, C. Saldias, N. Ovando - JAO/ADC), LSST (Jeffrey Kantor), and ended with Open Discussion/Coordination.

Providers Updates session started with presentations on AmLight updates AmLight1: International links (Julio Ibarra) and AmLight2: Connections/Protocols/Developments/QoS (Jeronimo Bezerra, Vinicius Arcanjo), continued with presentations from REUNA (Sandra Jaque), RedCLARA (Luis Eliécer Cadenas), RNP (Michael Stanton), ANSP perfSonar Demo (Jeronimo Bezerra), Internet2 (John Hicks) and ended with Open Discussion/Coordination.
Questions and comments were discussed in person and from the remote participants.

4.1.1 Association of Universities for Research in Astronomy (AURA)

Today's scientific instruments require collected data to be sent to a data center for processing and archiving. For example, the Dark Energy Survey (DES) sends data to the National Center for Supercomputing Applications (NCSA), then advanced data products are sent to Brazil, and back to NCSA. Future data produced from LSST will be sent to NSCA and from there to the National institute of nuclear and particle physics (IN2P3)[1] (France) for joint analyses and results redistribution. Next, ALMA's data is analyzed at the Joint ALMA Office (JAO), then distributed to archiving centers, and then sent back to JAO.

Discovery and follow-ups in real time for events like GW170817 were discussed. The Gemini data allowed multiple research teams to form a complete picture of the aftermath from the gravitational wave event (GW170817) localized by LIGO (Laser Interferometer Gravitational-Wave Observatory), Virgo, and the Fermi Gamma-ray Space Telescope on August 17, 2017[2]. Multiple detections at AURA, including the PROMPT5, DECam, LCOGT instruments, and extensive immediate follow-ups from GEMINI and SOAR telescopes.
Network Services required to accommodate alerts going out and being received, remote coordination of observations, immediate data transfer & reduction at remote sites, and remote coordination of follow-ups were discussed. The importance of the HUMAN network as a key to high quality connectivity was emphasized. High-quality connectivity isn't just about data, it's about linking scientists all around the world in real time to achieve "the impossible."

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[1] National institute of nuclear and particle physics (IN2P3)
[2] "Astronomers Feast on First Light from Gravitational Wave Event", Gemini Observatory Press Release, October 16, 2017, http://www.gemini.edu/node/12719?

4.1.2　National Radio Astronomy Observatory (NRAO)

Updates on data transfer from ALMA to North America were presented by the NRAO team. Current work is on data transfer within Chile on establishing network monitoring, and improving the understanding of how the link performs in high load conditions (~1TB/day). ALMA telescope science data rate Cycle 4 observations have been completed in September 2017. In the current Cycle 5 started October 2017, data is transmitted in 2 streams (WVR corrected and uncorrected) where 45% of array time is for science. More antennas will be added (43 compared to 40). The total volume could reach ~360TB, including image products which will constitute about 50% of the total data volume. For the future cycles, the raw data rates will continue to increase. Mean data rates ~100Mb/s are expected during observations for Cycle 6. "Duty cycle" of observations will also increase as testing and maintenance procedures improve.
In addition, a MOU between AURA/AUI is signed for a local link to SCO and additional link from NRAO to Internet2 through UVa was established at 10Gb/s.

4.1.3　Atacama Large Millimeter/Submillimeter Array (ALMA) Communication Infrastructure

ALMA Communication Infrastructure updates on system performance, downtime events, and availability were presented. Several new projects (4 to date) started the process to apply for resources, some of them form access to the communication system. Also, a proof of concept experiment is on-going to create a 100Mbps connection between the APEX antenna at the Chajnantor plateau and the APEX scientific data archive operated by ESO Garching (Germany).

4.1.4　Large Synoptic Survey Telescope (LSST)

Updates on multiple sites and connectors to LSST was presented:
- Summit to Base (Telefonica/Cobra install fiber, Raylex DWDM equipment, operated by AURA/REUNA);
- Base LAN (AURA procure/install/operate);
- Base to Santiago (Telefonica/Cobra install fiber, Raylex DWDM equipment, operated by REUNA);
- Santiago to Chicago (FIU/AmLight provision, manage operations, ESNet participation)

Network Diversity between sites and centers was discussed along with the dedicated long-haul network. Four new dark fibers in a 96 filament commercial bundle from La Serrena to Vicuna and to Santiago and 12 private fiber pair bundles for LSST and REUNA use were installed. The 100 Gbps ring Santiago-Miami is operational and the spectrum on the new Monet Cable Sao Paolo to Boca Raton is in progress. DWDM Equipment (Coriant) is purchased for Chile and will be installed by November 2017. Negotiations between LSST US Long Haul Network Links, Internet2, and ESNet for primary and secondary paths are ongoing and an agreement between LSST/FIU, and Angola cable was executed.

4.1.5　Americas Lightpaths Express and Protect (AmLight ExP[3])

Network Services updates presented by AmLight ExP included:
- Adding Santiago, Chile and Fortaleza, Brazil to 100G ring in Q4 2017
- Extending AMPATH to Boca Raton
- Spectrum for the Express in AmLight-ExP expected by December 2017
- 10G links for additional protection

In response to the growing demand, the AtlanticWave-SDX[4] (Awave-SDX) project is building a distributed intercontinental experimental SDX[5]. The goal of the SDX is to support end-to-end services capable of spanning multiple SDN domains, use application provisioning of end-to-end Layer 2 circuits, and providing network programmability. An SDX allows multiple independent administrative domains to share

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[3] NSF Award #ACI-1451018 - IRNC: Backbone: AmLight Express and Protect (ExP), https://www.nsf.gov/awardsearch/showAward?AWD_ID=1451018&HistoricalAwards=false
[4] NSF Award # 1451024 - IRNC: RXP: AtlanticWave-Software Defined Exchange: A Distributed Intercontinental Experimental Software Defined Exchange (SDX) https://www.nsf.gov/awardsearch/showAward?AWD_ID=1451024&HistoricalAwards=false
[5] Florida International University (FIU) and Georgia Institute of Technology (GT) are implementing AtlanticWave-SDX, in collaboration with other exchange points supporting SDN

computing, storage, and networking resources. For a domain scientist, an SDX can automate the provisioning of a network connection, allocate resources, schedule a workflow, and release network resources.

4.1.6   QoS and redundancy path at Americas Lightpaths Express and Protect (AmLight ExP)

US Networks supporting end-to-end LSST plan path and redundancy scenarios at sites in Miami, Boca Raton, Atlanta were presented. Also, LSST QoS policy test plan along with LSST network traffic types was reported. The production network that will transport LSST traffic, consists of two 40G and 100G interfaces. Considering that network switches provide QoS prioritization and scheduling queues at the interface level, the QoS policy should be based on the transmission bandwidth of each interface.

4.1.7   National Network for Research and Education in Chile, REUNA

National optical network upgrades mentioned in REUNA's Network Infrastructure Strategic Plan for 2017-2020 were reported. A spectrum solution from La Serena to north (La Serena – Copiapó, Copiapó-Antofagasta, Antofagasta-Calama, Calama-Arica) was discussed. Connections from Santiago to the south network design scheduled for 2017 and will be deployed for Q2 2018 (one pair fiber for long term agreement, 80 lambdas, and lambdas 100/200Gbps and 10Gbps). DWDM equipment has been installed along La Serena to Santiago, plus the Santiago metro ring. REUNA-Level3 activated on October 16, 2017, the first 100G from Santiago to La Serena. Next steps are finishing the link from La Serena to Santiago, La Serena-Summit, and installation of AURA's equipment, and deploying backup links in Santiago.

Building Europe Link to Latin America (BELLA) project[6] started March 31, 2016, and consists of two subprojects BELLA-T and BELLA-S. Current BELLA partners are CEDIA, RedCLARA, DFN, FCT, GARR, GEANT, RED. ES, RENATA, RENATER, REUNA, and RNP. The goal of the BELLA-T is to provide secure & resilient Latin American backbone, which allow equal access from Latin America to Europe, support of 100Gbps wavelengths in South America.

4.1.8   Brazil's academic network - Rede Nacional de Ensino e Pesquisa (RNP)

RNP goals are to build a scalable network infrastructure to expand the capacity of its network whilst reducing running costs and provide network infrastructure required by the BELLA-T project[7]. Current RNP National Backbone upgraded the links from Fortaleza to Porto Alegre to 100G Southeast ring. The nx100G network will be built with Companhia Hidro Elétrica do São Francisco (CHESF).
Also, RNP is committed to provide connectivity between São Paulo and Santiago 2 x 100 G and an additional 100 G of burst traffic by 2019. The agreement will last till 2032.
RNP connections necessary for LSST data transfer include:
- Florida to Sao Paulo via Fortaleza using Monet Cable
- Sao Paulo to Porto Alegre upgrade to scalable, shared infra RNP + Bella-T by 2018 and n × 100G, potential partners Furnas, Eletrosul, and BRFibra.
- Porto Alegre to Buenos Aires (RNP & RedCLARA)- right to use ½ of dark fiber n x 100G by 2018
- Buenos Aires to Santiago (with RedCLARA /Innovared)- Currently, up to 16x 10G channel DWDM between Buenos Aires and Santiago, Chile, with a total length of more than 2,200 km. and should be upgraded to 100G as part of BELLA-T by end 2018

4.1.9   RedCLARA

RedCLARA presented a future plan for the terrestrial network evolution including:
- Financial stability and sustainability.

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[6] Tender for Telecommunications Infrastructure and Services to connect the national research and education networks (NRENs) of: Brazil, Argentina, Chile, Peru, Ecuador, and Colombia, as well as infrastructure for Chile and a submarine connection between Colombia and Brazil. https://bella-tender.redclara.net
[7] BELLA-T (terrestrial network) – Currently, tenders are in course for completing the new DWDM 100G network linking South American NRENs by 2020

- Evolution of transport infrastructure BELLA-T: Complete bidding processes, Complete commitments of contributions from networks, Amexcid
- Establish a model for the exchange of services between NRENs
- CLARA-TEC for homologation of the architecture and evolution plan
- Specific alliances and support with the private sector and large providers
- Multiple network connection upgrades to 100G to Columbia, Argentina, Brazil, Peru, and Chile
- Back up connection

Steps to achieve the future goals discussed massive, coherent and shared investment in infrastructure and services under an approved architecture along with training of e-Science capabilities in NRENs - scientists and technicians, training of specialists (networks, SDN, virtualization, OpenStack) and in the processing of scientific data. Creation of public incentives to capture and share data (beyond just the publication) and confirmation of an e-Science market in the region was also discussed.

4.1.10 Academic Network at São Paulo (ANSP) on performance measurements

Performance measurement on the AmLight links using perfSonar servers were presented for:
- One Way Delay/ Round Trip Time
- 10G UDP Bandwidth Tests (Every 4 hours) (AURA not participating)
- TCP Bandwidth Tests (Every 4 hours)
- 1G UDP Bandwidth Tests between REUNA and AURA (every 24 hours)

Monitoring the links using AmLight Maddash portal: http://ps-dashboard.ampath.net/

4.1.11 Internet2 (I2)

I2 Core Network moved to single vendor platform based on MPLS (2016 - 2017). Targeted areas for the past year with regards to capacity were to improve analytics, perform the first wave of upgrades, leverage DCI at key interconnect locations, and providing SDN support. Optical updates were in the area of the auditing and compliance.
Long term evolution planning of the I2 network included:
- Community investment - not just backbone
- The target for capital investment is 2+ years out
- Re-emphasize our commitment to our research support missions
- Workforce impact - skills, processes, etc.
- Not everyone will be ready to engage day one and we have to maintain the community mindset that all can join and benefit when ready

I2 also discussed current engagement with the Global Network Architecture (GNA) which is in the process of developing GNA 2.0 standards. Many people from the community are engaged in the following current activities: enhanced measurement/monitoring, work on end-to-end capabilities, agreements on baseline services and functionalities, potential use of NFV tools, non-networking capabilities, and security and authentication.

Appendix A. Program for the SAACC Meeting

Thursday, October 19, 2017- Santiago, Chile
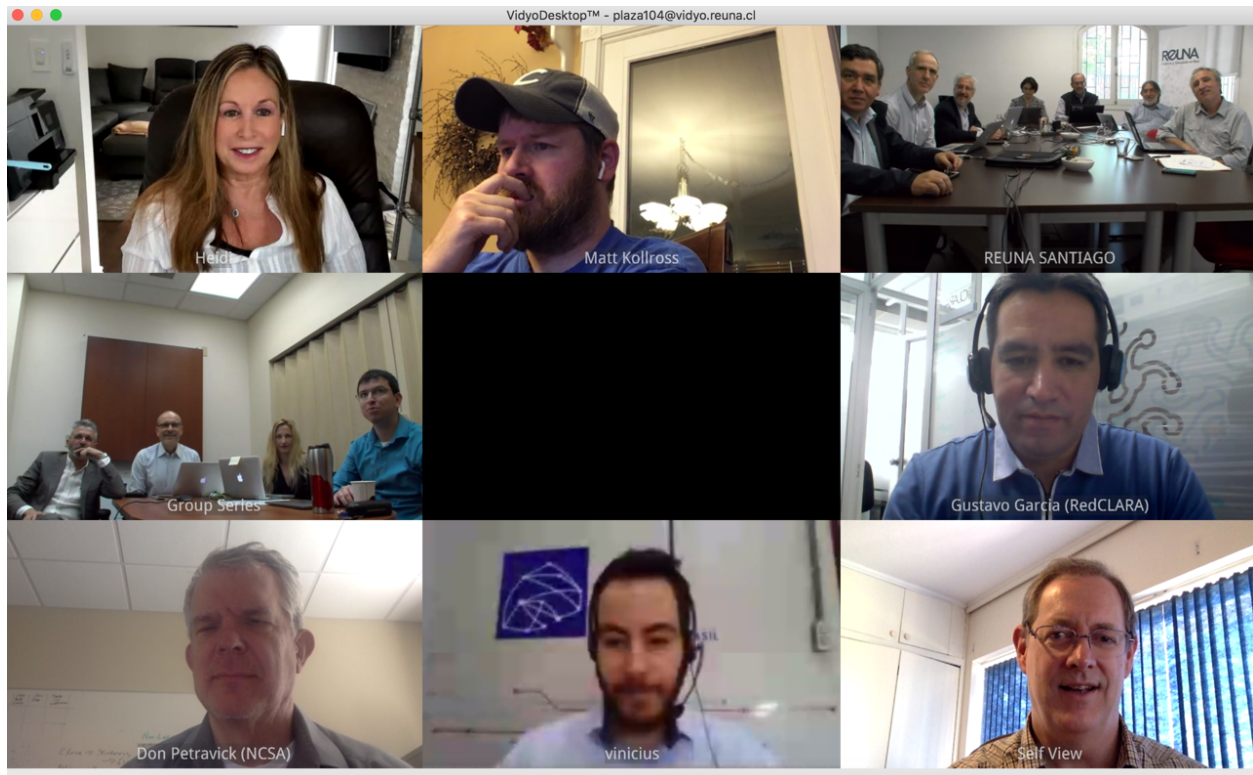
11:00 (CLST) Chile time – Welcome Remarks and Introduction – Chris Smith, SAACC Chair and Julio Ibarra, AmLight PI | Download presentation

Session I: Science Requirements & Activities Updates
11:10 – AURA (Chris Smith, Ronald Lambert)| Download presentation
11:30 – NRAO (David Halstead, Mark Lacy) | Download Presentation
11:50 – ALMA (Giorgio Filippi, Christian Saldias) | Download Presentation
12:10 – LSST (Jeffrey Kantor) | Download presentation
12:30 – Open Discussion/Coordination
12:50 – Lunch Break (50 min)

Session II: Providers updates
13:40 – AmLight1: (Julio Ibarra) | Download Presentation
14:00 – AmLight2: (Jeronimo Bezerra, Vinicius Arcanjo) Download presentation AmLight 2, QoS
14:20 – REUNA (Sandra Jaque) | Download presentation
14:40 – RNP (Michael Stanton, Eduardo Grizendi) | Download Presentation
15:00 – RedCLARA (Luis Eliécer Cadenas) | Download Presentation
15:20 – ANSP, perfSonar Demo (Jeronimo Bezerra) | Download Presentation
15:40 – Internet2 (John Hicks) | Download presentation
16:00 – Discussion and Closing Remarks. Adjourn

Appendix B. List of Participants

In person participants:
1. **Calisse, Paolo**; University of California San Diego (UCSD), (pcalisse@ucsd.edu)
2. **da Costa, Luiz**; Brazilian e-science/astronomy virtual institute LINEA (ldacosta@linea.gov.br)
3. **Filippi, Giorgio**; European Southern Observatory (ESO) (gfilippi@eso.org)
4. **Halstead, David**; National Radio Astronomy Observatory (NRAO) (dhalstea@nrao.edu)
5. **Jaque, Sandra**; National University Network Chile (Red Universitaria Nacional -REUNA) (sjaque@reuna.cl)
6. **Kantor, Jeffrey**; Large Synoptic Survey Telescope (LSST) (jkantor@lsst.org)
7. **Ovando, Nicolas;** Atacama Large Millimeter/submillimeter Array (ALMA) (novando@alma.cl)
8. **Salidias, Christian;** Atacama Large Millimeter/submillimeter Array (ALMA) (csaldias@alma.cl)
9. **Vinet, Andres;** European Southern Observatory (ESO), (avinet@eso.org)

Remote participants:
1. **Arcanjo, Vinicius**; Brazilian National Research and Educational Network (Rede Nacional de Ensino e Pesquisa -RNP) (vinicius@amlight.net)
2. **Bezerra, Jeronimo**; CIARA at Florida International University (FIU) (jbezerra@fiu.edu)
3. **Blair, James (Jim)**; Cerro Chajnantor Atacama Telescope (CCAT) (james.blair@cornell.edu)
4. **Cadenas Marín, Luis Eliécer**; Latin American Advanced Networks Cooperation (Cooperación Latino Americana de Redes Avanzadas-RedCLARA) (luis-eliecer.cadenas@redclara.net)
5. **Chergarova, Vasilka**; CIARA at Florida International University (FIU) (vchergar@fiu.edu)
6. **Coral, Luis;** Large Synoptic Survey Telescope (LSST) (lcorral@lsst.org)
7. **Eichelberge, Corey**; National Center for Supercomputing Applications (NSCA) (eichelbc@illinois.edu)
8. **Garcia, Gustavo**; Latin American Advanced Networks Cooperation (Cooperación Latino Americana de Redes Avanzadas-RedCLARA) (gustavo.garcia@redclara.net)
9. **Griffin, Chris**; Florida LambdaRail – Florida's Research and Education Network (cgriffin@flrnet.org)
10. **Hazin, Aluizio**; Brazilian National Research and Educational Network (Rede Nacional de Ensino e Pesquisa -RNP) (aluizio@rnp.br)
11. **Hicks, John**; Internet2 (jhicks@internet2.edu)
12. **Ibarra, Julio**; CIARA at Florida International University (FIU) (julio@fiu.edu)
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15. **Lopez, Luis**; Academic Network at São Paulo (ANSP), Brazil (lopez@dim.fm.usp.br)
16. **Morgan, Heidi**; Information Science Institute (ISI) at University of Southern California (USC) (hlmorgan@isi.edu)
17. **Moura, Alex**; Brazilian National Research and Educational Network (Rede Nacional de Ensino e Pesquisa -RNP) (alex@rnp.br)
18. **Nolta, Mike**; Atacama Large Millimeter/submillimeter Array (ALMA), (mike@nolta.net)
19. **Parshley, Steve**; Cornell University (scp8@cornell.edu)
20. **Petravick, Donald**; National Center for Supercomputing Applications (NSCA) (petravic@illinois.edu)
21. **Sharp, Nigel;** National Science Foundation (NSF) (nsharp@nsf.gov)
22. **Smith, Chris**; Cerro Tololo Inter-American Observatory (CTIO), National Optical Astronomy Observatory (NOAO) (csmith@ctio.noao.edu)
23. **Stanton, Michael**; Brazilian National Research and Educational Network (Rede Nacional de Ensino e Pesquisa -RNP) (michael@rnp.br)
24. **Taylor, Lance**; Florida LambdaRail – Florida's Research and Education Network (lance.taylor@flrnet.org)
25. **Thompson, Kevin**; National Science Foundation (NSF) (kthompso@nsf.gov)
26. **Wefel, Paul**; Energy Sciences Network (ESnet) (pwefel@es.net)
27. **Wheeler, David**; National Center for Supercomputing Applications (NSCA) (dwheeler@illinois.edu)