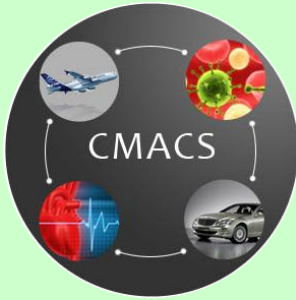
Computational Modeling and Analysis For Complex Systems
NSF Expedition in Computing

Leadership & Collaboration



Rance Cleaveland

CMACS Deputy Director

University of Maryland

2nd Year Review Meeting, Carnegie Mellon University

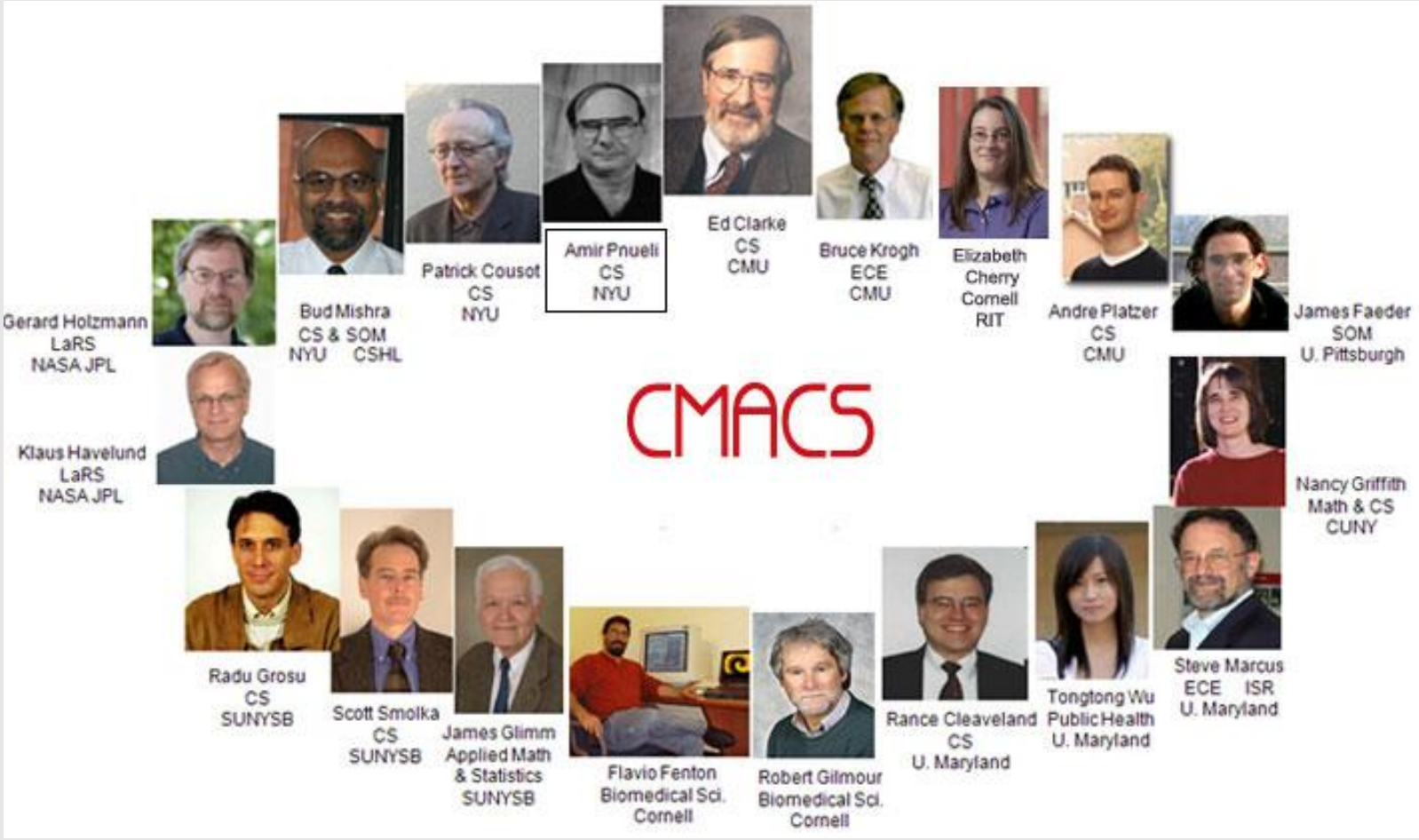
November 3, 2011

CMACS: An Overview

- Started in September 2009
- 8 institutions, 19 PIs, plus students & postdocs

- **Jet Propulsion Lab** joins CMACS in May 2011
  - Delay due to legal problems: ITAR regulations, ARRA (stimulus) funding restrictions
- Many **research and education successes already**, and infrastructure in place for many more!

CMACS: Research Team



CMACS Leadership Team

- Edmund M. Clarke (Carnegie Mellon – Lead PI)
- Rance Cleaveland (Maryland – Deputy Director)
- Scott Smolka (Stony Brook – Deputy Director)
- Paolo Zuliani (Carnegie Mellon – Technical Coordinator)
- Nancy Griffeth (Lehman – Education Director)
- Flavio Fenton (Cornell – Education Co-Director)
- Klaus Havelund (Jet Propulsion Lab)
- Denny Marous (CMU – Administrative Coordinator)

CMACS Advisory Board

- Ken Butts, PhD
  Toyota: Executive Engineer at Toyota Motor Engineering & Manufacturing North America
- David Dill, PhD
  Stanford University: Professor of Computer Science
- Michael T. Lotze, MD
  University of Pittsburgh: Professor of Surgery and Bioengineering; Vice Chair of Research within the Department of Surgery; Asst. Vice Chancellor in the six schools of the Health Sciences at Pitg; and Director of Strategic Partnerships within the University of Pittsburgh Cancer Institute
- Colin Hill
  GNS Healthcare: CEO, President, Chairman, and Co-Founder
- Steve Miller, PhD
  Rockwell-Collins: Principal Engineering Manager
- Janos Sztipanovits
  Vanderbilt University: E. Bronson Ingram Distinguished Professor of Engineering; Professor of Electrical Engineering and Professor of Computer Engineering; Director of the Institute for Software Integrated Systems

Management Approach

- CMACS is geographically, institutionally dispersed
- Team members are creative, ambitious, intellectual
- Management approach
  - Give team members opportunities to interact
  - Let their natural scientific impulses take over!

Interaction Opportunities

- CMACS PI review meetings:
  - Oct. 31 - Nov. 1, 2009. Kickoff meeting at CMU
  - Mar. 4-5, 2010. CMU
  - Oct. 28-29, 2010. NYU
  - April 28-29, 2011. UMD
- Bi-weekly teleconferences via Skype / webex
  - Management issues
  - Planning
  - Research presentations
- Research visits across institutions
- Our **wiki** http://wiki.cmacs.cs.cmu.edu
- Our **website** http://cmacs.cs.cmu.edu

CMACS: Whole >> Σ Parts

- Many breakthroughs due to **new**, **cross-institutional**, **cross-disciplinary collaborations**

- Typical example: Atrial Fibrillation Research

Stony Brook	Cornell/RIT	NYU
Bartocci (Computer Sci)	Cherry (Biomedical)	Le Guernic (Computer Sci)
Glimm (Applied Math)	Fenton (Physics)	
Grosu (Computer Sci)	Gilmour (Biomedical)	
Smolka (Computer Sci)		

CMACS: Whole >> Σ Parts

Low-energy control of electrical turbulence in the heart

Luther, Fenton, *et al*.

Nature 475, pp. 235–239, 2011.

From Cardiac Cells to Genetic Regulatory Networks

R. Grosu, G. Batt, F. H. Fenton, J. Glimm, C. Le Guernic, S. A. Smolka, E. Bartocci.

CAV 2011: 23rd International Conference on Computer-Aided Verification, LNCS 6806, pp. 396-411, 2011.

CMACS: Whole >> Σ Parts

- Another example: Pancreatic Cancer Research

CMU	Pitt	UMD	UPMC
Clarke (Computer Sci)	Faeder (Sys. Biol.)	Wu (Public Health)	Lotze (Cancer Inst.)
Gong (Computer Sci)	Miskov-Z. (Sys. Biol.)		
Wang (Computer Sci)			
Zuliani (Computer Sci)			

TGen (June 11)

Posner (Biophysics)

Von Hoff (Oncology)

- Tgen = **Translational Genomics Research Institute**

CMACS: Whole >> Σ Parts

- Pancreatic Cancer Research
- **Analysis and Verification of the HMGB1 Signaling Pathway**. Gong, Zuliani, Komuravelli, Faeder, Clarke.
  BMC Bioinformatics 2010. ***Best Paper Award at InCoB 2010***.
- **Computational Modeling and Verification of Signaling Pathways in Cancer**. Gong, Zuliani, Komuravelli, Faeder, Clarke.
  Algebraic and Numeric Biology 2010.
- **A Transcriptome Analysis by Lasso Penalized Cox Regression for Pancreatic Cancer Survival**.
  Wu, Gong, Clarke. *Journal of Bioinformatics and Computational Biology*.
- *… see our website for more papers*

CMACS: Whole >> Σ Parts

- Another example: Education Programs
  - Course modules
  - Student research workshops
    - Expose undergrads to CMACS, scientific research
    - Enable them to engage in science
    - Publications!
    - Excellent feedback
  - Curricular efforts

CMACS: Whole >> Σ Parts

- Another example: Outreach
  - Advisory board
  - Industrial workshops

Management Challenges Moving Forward

- Continue to promote interactions among researchers
- Enhance mechanisms for integration of research results across challenge problems
- Grooming of new leaders