



Cyberinfrastructure and Scientific Collaboration:

Application of a Virtual Team Performance Framework to GLOW II Teams

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Cyberinfrastructure and Collaboration

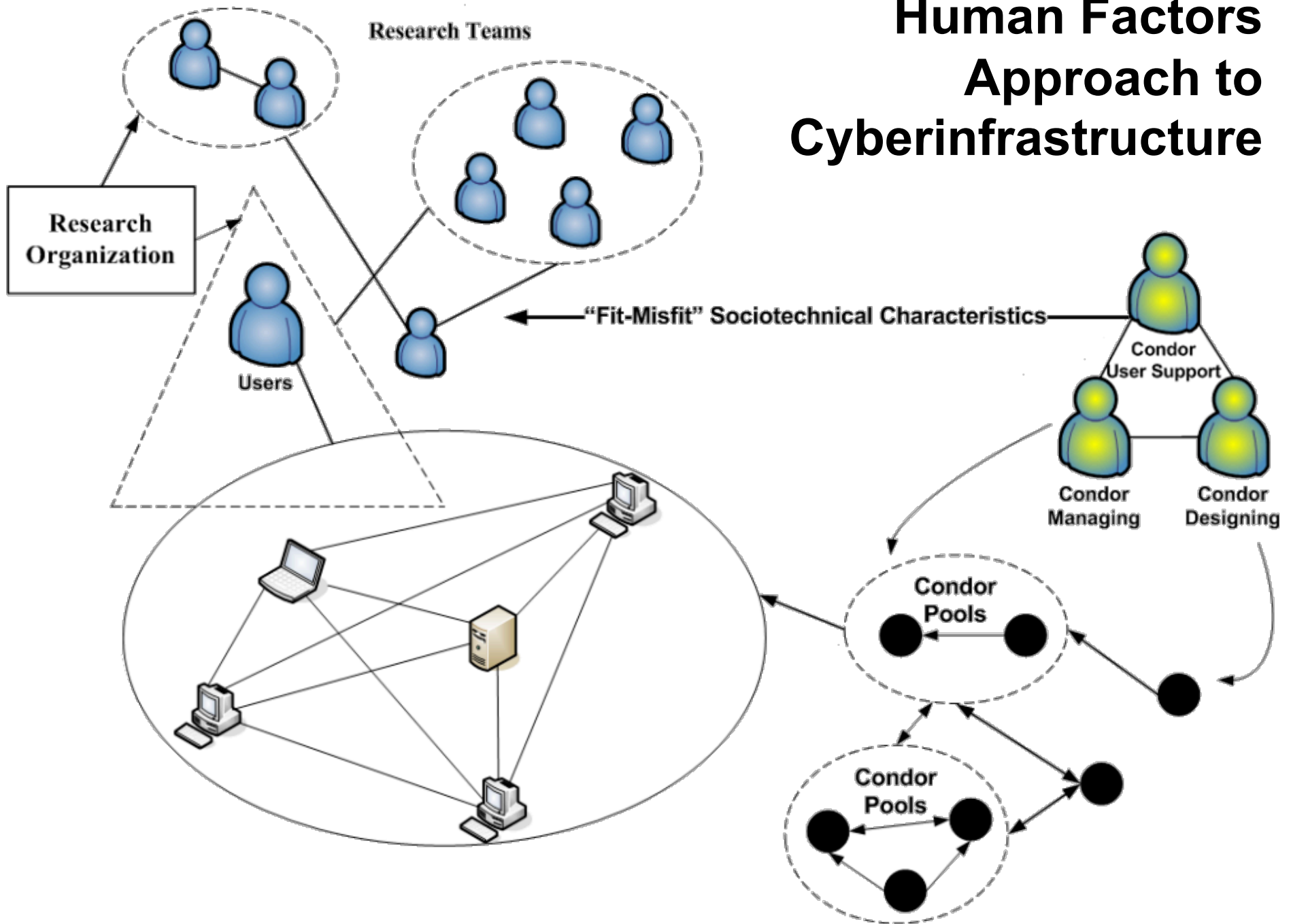
- Cyberinfrastructure has enabled new forms of large-scale distributed scientific enterprises
- Strong need for effective coordination and systemization of research across disciplines¹
 - Sites may adopt different formats/representations
 - Effective use could break down disciplinary boundaries
 - Need awareness of cross-site development activities to streamline time, talent

¹Report of the NSF Blue-Ribbon Panel on Cyberinfrastructure (2003)

Virtual Teams in HTC: Definition

- Virtual teams in high throughput computing may vary across:
 - time and geography,
 - domains of science,
 - team size,
 - background or culture,
 - type of task,
 - type of research problems (e.g., applied, basic),
 - computational needs,
 - fluidity of membership in the HTC community,
 - and degree of interdisciplinarity within their scientific domain and/or across research projects

Human Factors Approach to Cyberinfrastructure



Condor Project + Scientific Collaboration

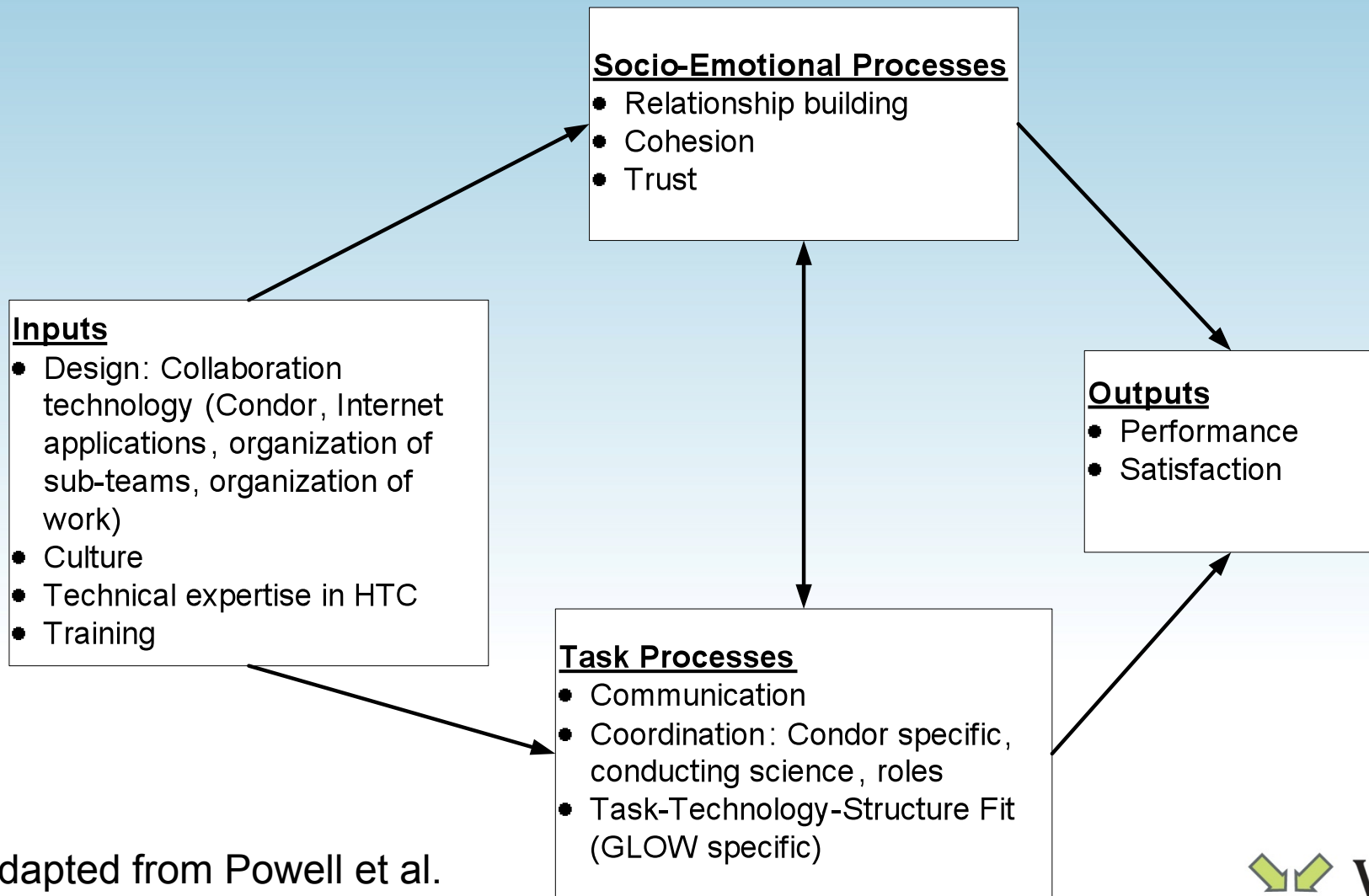
- Condor's Philosophy of Flexibility²
 - Let communities grow naturally
 - Leave the owner in control
 - Plan without being picky
 - Lend and borrow
 - Understand previous research
- Links virtual team collaborations via Condor pools, facilitates coordination via networks of *people* and *resources*

²Thain et al. (2005). *Distributed computing in practice: The condor experience.*

Research Questions

- What are the sociotechnical characteristics of virtual teams using Condor and HTC technologies?
- How do the characteristics of specific HTC technology (Condor) affect virtual team performance and collaboration?

Sociotechnical Model of Virtual Teams Using HTC³



³Adapted from Powell et al. (2004)

Exploratory Study with Grid Laboratory of Wisconsin (GLOW II Project Teams)

- GLOW II
 - Interdisciplinary team of 10 research teams collaborating and using shared HTC resources
 - Collaborate in the development, implementation, testing, sharing, and deployment of HTC resources while conducting interdisciplinary science
- How should teams/collaborations be designed and supported?

Study Design - 1

- Focus groups with 2 interdisciplinary GLOW II teams:
 - IceCube
 - Search for dark matter with South Pole telescope
 - Over 250 people in 35 institutions
 - Condor/GLOW computational power for all scientific analyses and simulations
 - Laboratory for Molecular for Computational Geonomics (LMCG)
 - Investigates single molecule phenomena; creation of new systems in biological sciences
 - 13 people at UW-Madison; 2-3 off-campus collaborators

Study Design - 2

- Audio-recorded and notes
- Systematic content analysis with qualitative research software support
- Used Virtual Team Performance Framework as foundation of qualitative analysis

Input Factors for Team Performance Results – 1

Categories	IceCube	LMCG
Culture	2	1
Technical expertise	1	2
Training	0	1

Culture (Icecube):

“And they [astronomers] are interested in more data and better data. And they've been very successful at this. And that's how they operate. Doing something new [telescope], that's left to physicists. That's the history...”

(LMCG):

They strive to hire team members that are diverse in: inquisitiveness, creativity, productiveness. “Differences bring people together”

Input Team Design Factors Results – 2

Categories	Sub-categories	IceCube	LMCG
Collaboration technologies	Condor and HTC	6	1
	Internet resources and phone	5	0
Leadership		4	0
Organization of sub-teams		3	0
Organization of work		10	1
Membership size		1	1

Socio-Emotional Process Factors Results - 3

Categories	IceCube	LMCG
Relationship building	2	0
Trust	2	0
Cohesion	0	0

Trust (IceCube)

“We totally outraced that competition. [...] And it's partly because the group is small.”

Task Processes Results – 4

Categories	Sub-categories	IceCube	LMCG
Coordination	Conducting science	3	0
	Condor-specific	2	3
	Inter- and intra team coordination	9	1
	Roles	4	0
Task-technology-structure fit		4	0
Communication		0	0

Output Factors Results – 5

Categories	Sub-categories	IceCube	LMCG
Performance	Technical output	1	1
	Publishing research – grant cycles	1	0
Satisfaction		1	1

Potential Sociotechnical Design Areas

- Codify team performance factors for inter-team collaboration
 - Coordination of resources; HTC support within teams
 - Importance of the HFT/Condor liaison embedded in each team
- Coordination vs. Collaboration?
 - Brings together many disciplines and problem spaces
 - Are teams truly collaborating or just coordinating?

Further Study + Limitations

- 2 teams and 2 data collection points = Exploratory
- Expand to include more teams
- Examine GLOW II cross-team interactions
- Include Condor staff perspective

Questions + Contact Info + Acknowledgements

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