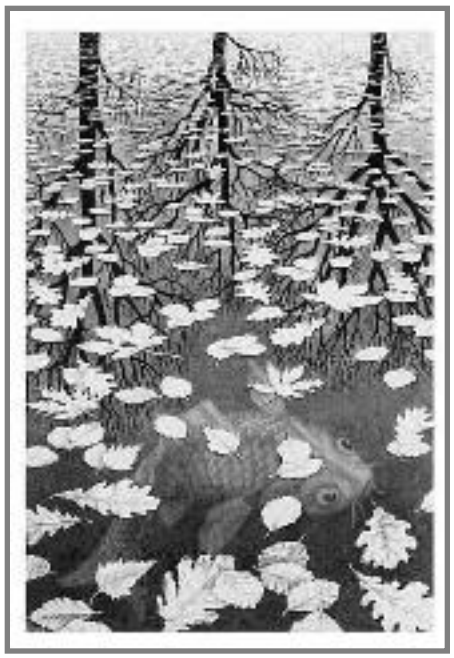


Leading Across Cultures: *Observations from the Cyberinfrastructure Front*

Dr. Fran Berman

Director, San Diego Supercomputer Center

Professor and HPC Endowed Chair, UC San Diego

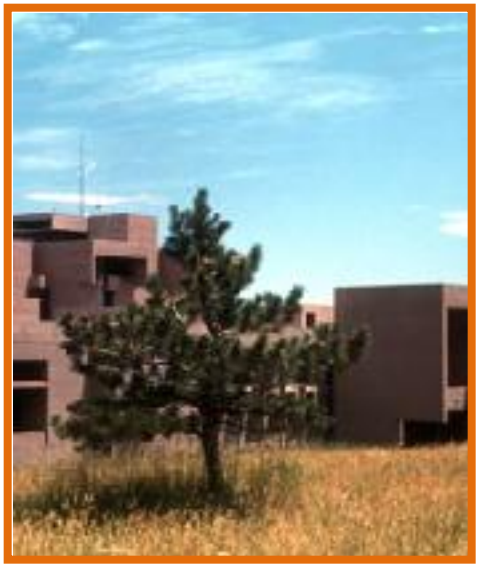
Characterizing Culture

- "Culture can be defined as all the behaviors, arts, beliefs and institutions of a population that are passed down from generation to generation. Culture has been called "the way of life for an entire society." As such, it includes codes of manners, dress, language, religion, rituals, norms of behavior such as law and morality, and systems of belief as well as the arts and gastronomy." *Wikipedia*

Cultural Differentiators

- 4 dimensions which differentiate (national) cultures
  - **Uncertainty avoidance:** *The extent to which individuals take steps to control risk and the unknown*
  - **Power distance:** *The extent to which individuals prefer formal and hierarchical relationships compared to more informal and egalitarian relationships*
  - **Masculinity vs. femininity:** *The extent to which gender and gender roles are emphasized*
  - **Individualism vs. collectivism:** *The extent to which individuality is valued as compared to collectivism*
- *Can also be used to differentiate professional cultures*

Navigating Across Cultures



How to translate

- Modes of communication
- Metrics and means of success
- What things mean
- Power hierarchies
- Roles of the past, future etc.

Prevailing Environment for Cyberinfrastructure: Academic Culture

- **Key characteristics**
  - Research goals often very high-level and progress hard to quantify. Research innovation generally prioritized over methodical development, education.
  - New ideas key; quantifiable processes, procedures are not as well-defined or ubiquitous as industry (e.g. ad hoc software engineering)
  - Political positioning/credit key to set up participants for future funding
  - Incentives, recognition promote individual contributions, teamwork more challenging in this context
  - Geographical cultural boundaries may have less impact than other cultural boundaries

Geography is Often Less Important than other Academic Boundaries

- National funding typically focused on national researchers, global researchers not typically competing for same funding
- *Science is global*: Much stronger cultural boundaries across domains, projects than places of residence
- **Caveat:** US, EU, Asian, and other academic systems differ substantively and have a real impact on who participates and how funding is allocated.

Classic Academic Cultural Challenges

- ***Divergent goals: "Hatfields + McCoys" conflicts***
  - Researchers + service providers
  - Researchers + users
  - Competing missions
  - Group-developed technologies
  - Cross-"boundary" collaborations
- ***Simultaneous Collaboration and Competition***
  - Collaboration key for project "success" (team effort); individual contribution key to position for future funding (individual credit, visibility)
  - Fuzzy evaluation: program officer, review committee, community unknown factors
  - Current status and dependency on "soft money" a critical factor

A Cultural "Grand Challenge": Cyberinfrastructure

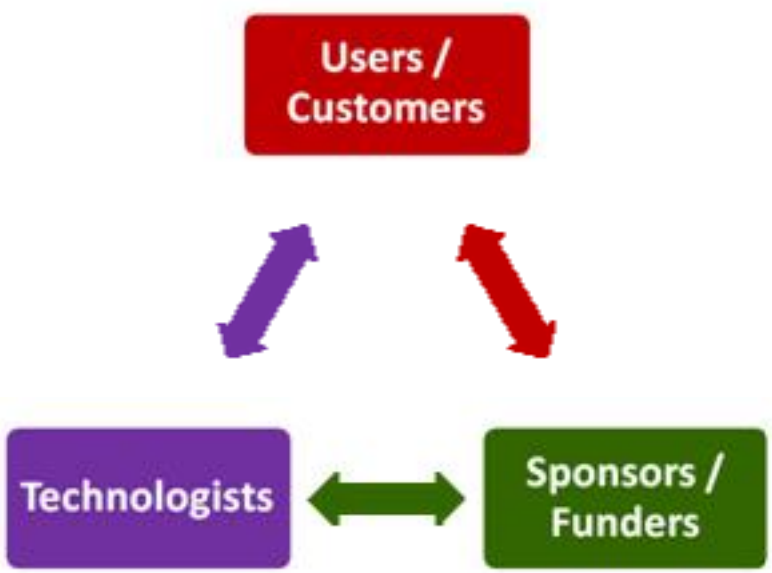
- **Cyberinfrastructure** is the organized aggregate of technologies that enable us to access and integrate today's IT resources to facilitate science and societal goals.
- **Cyberinfrastructure = resources** (computers, data, networks, instruments, viz, experts, etc.) **+ "glue"** (SW, virtual organizations, etc.)

Cyberinfrastructure is an international phenomenon

- **CTWatch Quarterly, February 2006:** ***International Cyberinfrastructure: Activities Around the Globe***
  - A national Grid Infrastructure for Australian Researchers
  - Cyberinfrastructure for Multidisciplinary Science in Brazil
  - GARUDA: India's National Grid Computing Initiative
  - Cyber Science Infrastructure Initiative for Boosting Japan's Scientific Research
  - Construction and Utilization of the Cyberinfrastructure in Korea
  - High Performance Computing in South Africa: Computing in Support of African Development
  - Taiwan's Cyberinfrastructure for Knowledge Innovation
  - PRAGMA: Example of Grass-Roots Grid Promoting Collaborative e-Science Teams

Cyberinfrastructure Projects must bridge multiple cultures

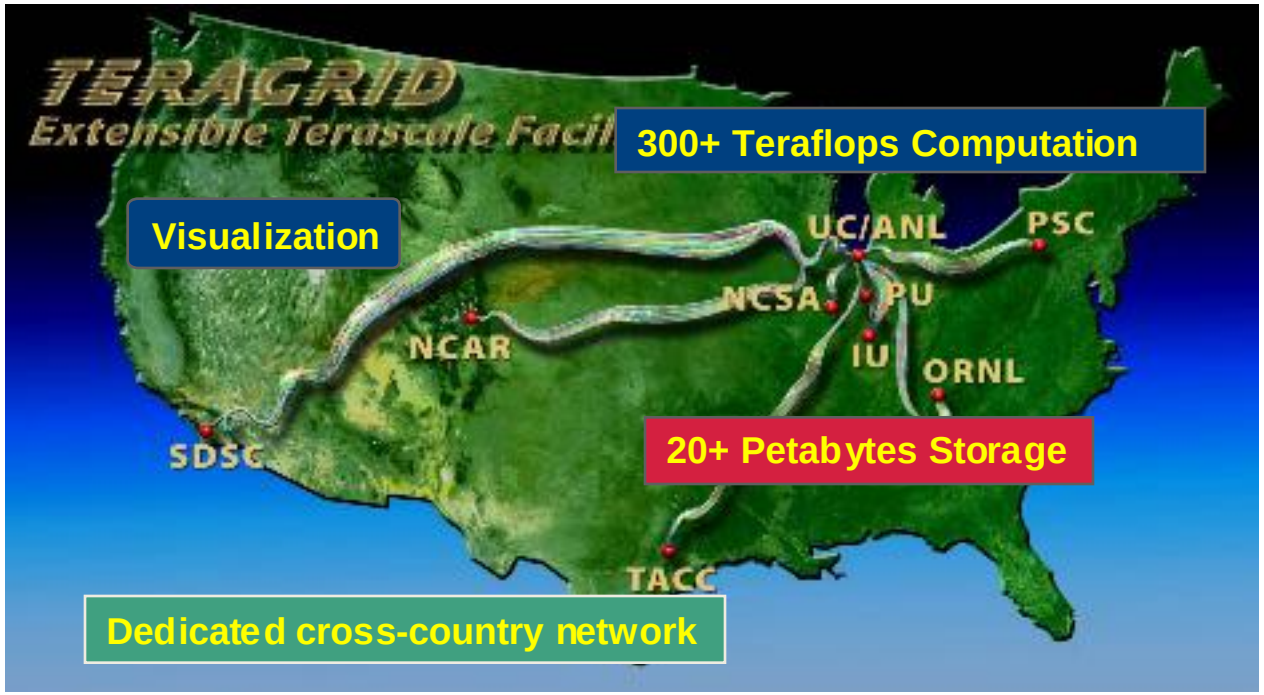
- Institutional cultures
- Research cultures
- Service cultures
- Domain cultures (attitudes on sharing, communication, modes of work)
- Sector cultures (academic, private, federal)
- Educational cultures (teachers, students)
- Geographic cultures



All communication links must function well

Case Study: TeraGrid

- NSF-funded facility to offer high end compute, data and visualization resources, integrated by common SW infrastructure to the nation's academic researchers

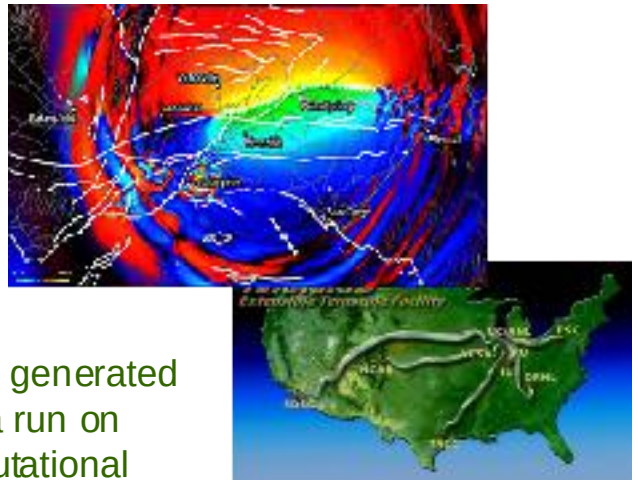


Using TeraGrid

Scientific Question:
What is the impact of a large-scale (7.7) earthquake on the lower San Andreas Fault?

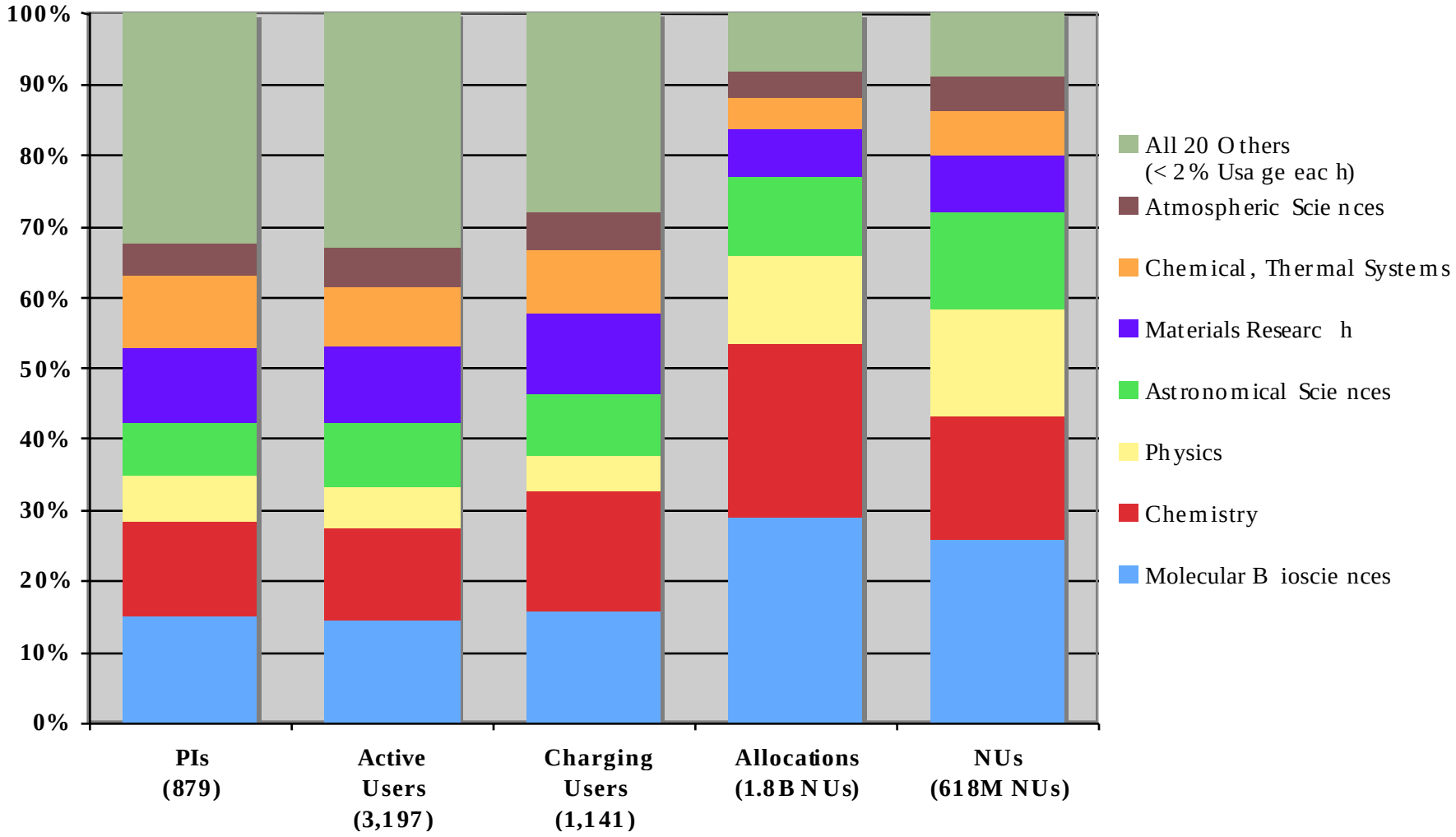
Scientists develop predictive model for earthquake behavior which combines sensor data, current thinking on earthquake behavior, algorithms which leverage HPC capabilities

Model run on TeraGrid resources. Choreography of computation and data storage important to archive generated simulation output



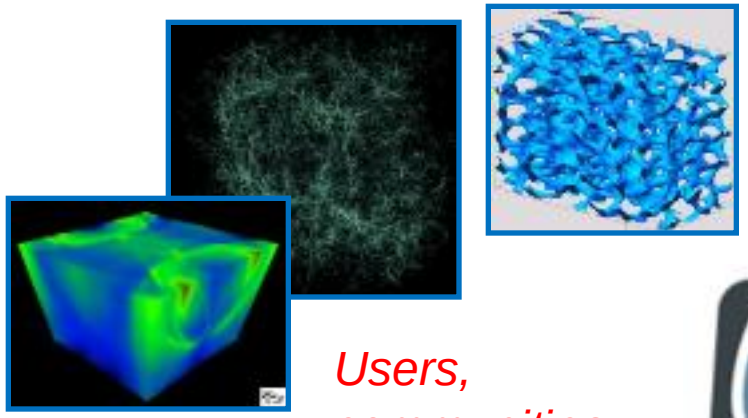
Visualization using generated simulation data run on TeraGrid computational resources and archived as derived data in TeraGrid storage.

TeraGrid Users by domain



Information courtesy of Dave Hart

TeraGrid Subcultures



Users, communities

Federal Agencies

TeraGrid™

Institutions

Developers, Technologists

Project History

- **2001** (start of Construction and Early Operations program): Original joint proposal sent in by Dan Reed (NCSA) and Fran Berman (SDSC), PIs, to develop national distributed cluster (same architecture at all sites) at UIUC, UCSD, ANL, CalTech
- **2002:** TeraGrid expanded to include PSC, heterogeneous resources became the norm
- **2004:** Additional partners TACC, IU, PU and ORNL join TeraGrid. Focus is on a national heterogeneous Grid environment.
- **2005** (start of Operations program): New program incorporates Grid Integration Group (GIG) and Resource Providers (RP)
- **2006+:** NCAR, others join TeraGrid. Committees meeting to plan TG post-2009, NSF RFP expected in 2008-2009.

TeraGrid Technical Challenges

- Both a development and a deployment project
- Common software environment developed and deployed by cross-institutional group
- Coordinated middleware environment developed and deployed by cross-institutional group
- Highly heterogeneous hardware
- Need for interoperability with other Grid efforts
- Usability, reliability, monitorability, etc.
- Need for both centralization and distribution
- Scope creep

TeraGrid Social/Political Challenges

- Expectation management
- Decisions targeting users made by stakeholders; weak accountability mechanisms
- Common software environment developed and deployed by cross-institutional group
- Coordinated middleware environment developed and deployed by cross-institutional group
- Credit/positioning
- “Academic” governance model
- Centralization with/vs. distribution: staff
- Distribution of funding

TeraGrid Organization Today

- Organizational Components
  - Grid Integration Group (GIG)
  - Resource Providers (coordinated through RP Forum)
  - Working Groups (persistent)
  - Requirements Analysis Teams (agile)
  - Advisory Groups
    - GIG: Executive Steering Committee (ESC)
    - Scientific Advisory Board (SAB)

Work in progress:

- "Governance RAT"
  - Clarifiying power relationships between RP Forum and GIG
- Scientific Advisory Board (formerly Cyberinfrastructure User Advisory Committee)
  - Focusing on development of useful mission and relationship to project

Information courtesy of TeraGrid (Dane Skow and Charlie Catlett)

Cultural Differentiators Applied to TeraGrid

Focus: TeraGrid infrastructure	**Users / Customers**	**Developers / Technologists**	**Institutions**	**Federal Agencies**
Uncertainty avoidance: *The extent to which individuals take steps to control risk and the unknown*	Users want stable, predictable infrastructure (risk-averse); comfortable with unpredictable scientific results (risky)	Academic developers, technologists want to do interesting work (more risky), also provide good service (more risk-averse)	Institutions want national visibility from participation (risk averse)	Agencies want successful results, visible return on investment (risk averse)
Power distance: *The extent to which individuals prefer formal and hierarchical relationships*	Users comfortable with informal relationships	Developers comfortable with informal relationships	Institutional relationships follow set protocols	Government relationships follow set protocols
Masculinity vs. femininity: *The extent to which gender and gender roles are emphasized*	Users want environment to be supportive and nurturing	Developers / technologists want to do best-of-breed, cool stuff	Hierarchy and power relationships part of institutional culture	Hierarchy and power relationships part of federal culture
Individualism vs. collectivism: *The extent to which individuality is valued as compared to collectivism*	Users want support for individual use models	Infrastructure must support both common infrastructure and customization	Institutional differences must be accommodated	Agency differences must be accommodated

- Most Challenging TeraGrid Cultural Issues
  - How to collaborate in a competitive environment
  - How to manage project with multiple individual awards
  - “evaluation by community” model makes it hard to set and move towards concrete goals
  - Management by committee
  - Scoping

- Successful techniques:
  - Uniform branding
  - Single points of contact for users (accounting, science gateway portals)
  - Frequent and regular targeted meetings for technical and other staff to keep communication channels open
  - Balance of base service uniformity and customization (kits)

TeraGrid is not unique: Cross-cultural issues being explored by virtually every Cyberinfrastructure project world-wide

TeraGrid

NVO

GRID@ASIA

GEON
The Geosciences Network

NEES Consortium, Inc.

PRAGMA

Open Science Grid

eGee
Enabling Grids for E-sciencE

BIRN

Communicating Across Cultures

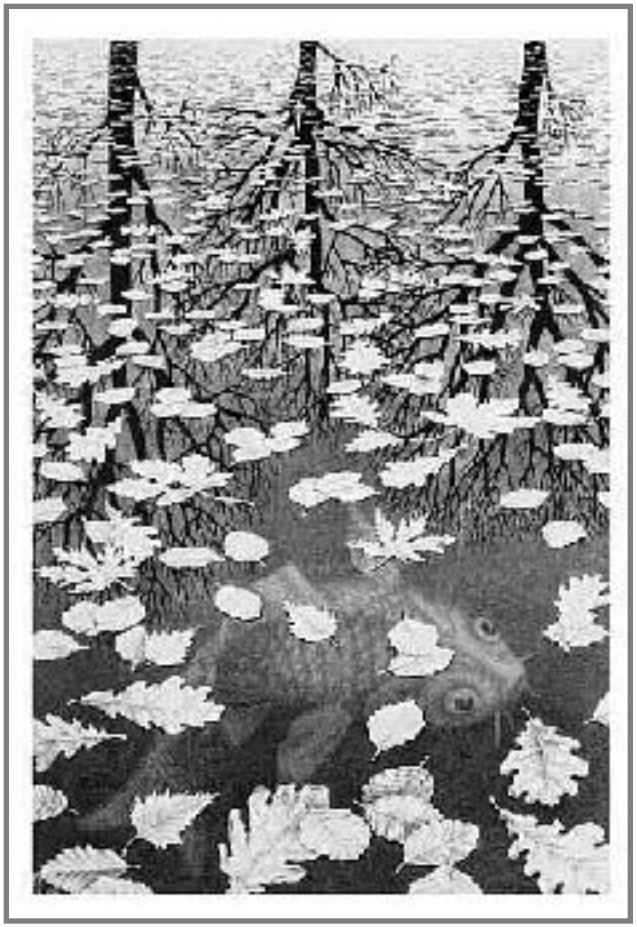
- What is success?
- How is it measured?
- What do key things mean?
- What are the key modes of interaction?
- What are the power relationships?
- Who needs credit?

Successful Techniques for overcoming Cultural boundaries

- Co-location of multiple cultures
- Agreement on precise meaning of “common” terms and deliverables
- Informal communication (“management by having coffee”)
- Over-riding belief: Focus of leadership should be to guide participants to rise above cultural differences for something they believe in
- Shared incentives: Success dependent on activities of group rather than individuals

Key Ideas 1

- Success must be meaningful for all
  - What's considered a "success"?
  - What's considered a "failure"?
  - What is the importance of succeeding/failing?



Key Ideas 2

- Optimization for the long-term may be different than short-term optimization strategies
  - Sub-optimal strategies/Gaffs/"failure" may be more forgivable if long-term relationship preserved

Key Ideas 3

- Leading across cultures can change cultures but it's a long-term effort and a by-product rather than a goal