System Development and Project Organization (BSUP)

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Global Software Development

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Outline

- What is Global Software Development?
- Why Global Software Development?
  - Kinds of distribution
- Challenges
- Approaches
  - Tools
  - Processes

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What is Global Software Development?

- Global Software Development
- Global Software Engineering
- Distributed Software Development
- Distributed Software Engineering
- Multi-site software development
- Offshoring
- …

"[It] means splitting the development of the same product or service among globally distributed sites."

Lanubile, F. (2009). Collaboration in distributed software development. International Summer School on Software Engineering, ISSSE.

"Software work undertaken at geographically separated locations across national boundaries in a coordinated fashion involving real time or asynchronous interactions"

Sahay, S., Nicholson, B., & Krishna, S. (2003). Global IT outsourcing: software development across borders. Cambridge University Press.

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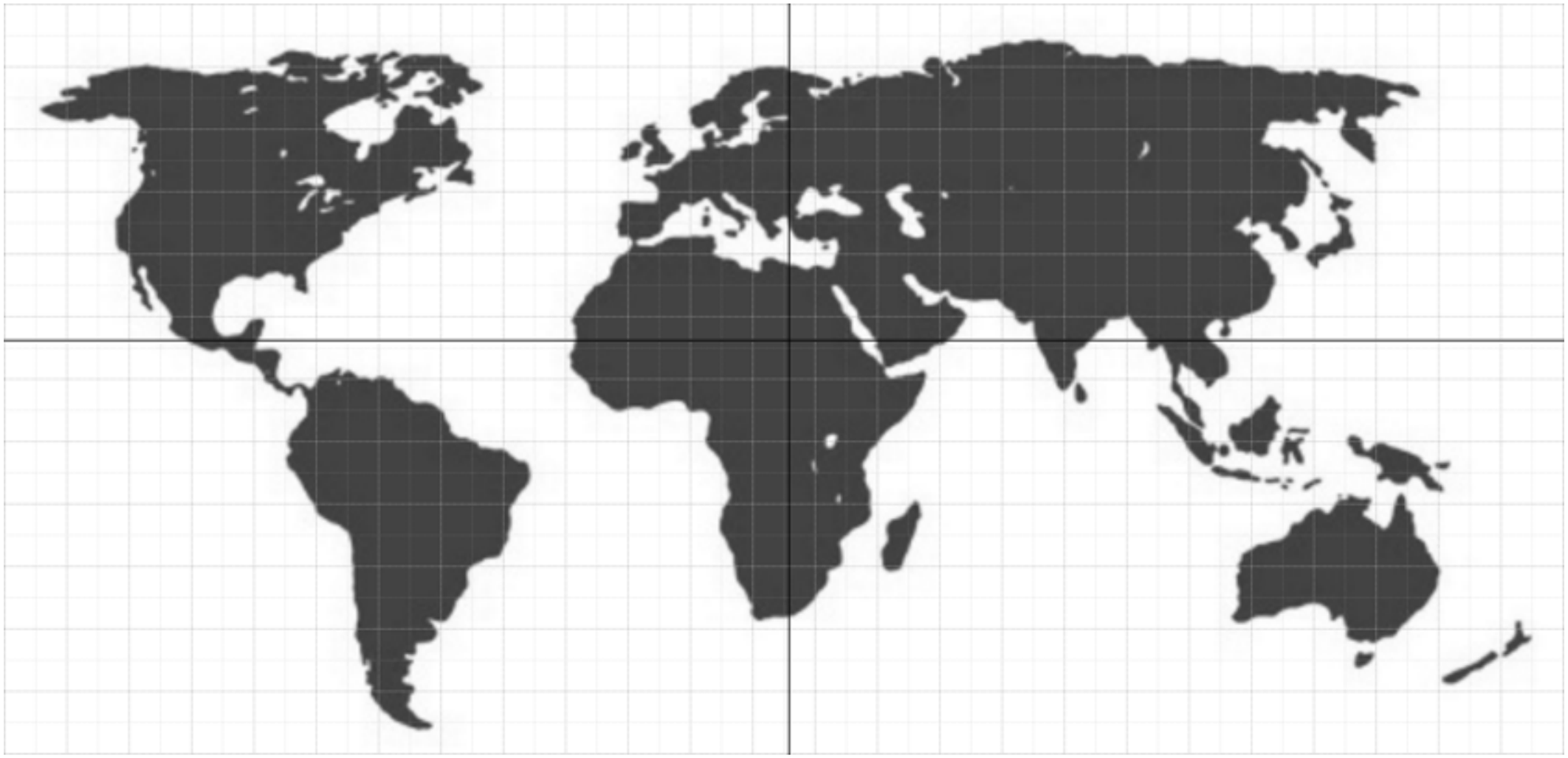
Why Global Software Development? — benefits

- Most talented developers
- Development costs
- Proximity to market
- Time to market (e.g., follow-the-sun)
- …

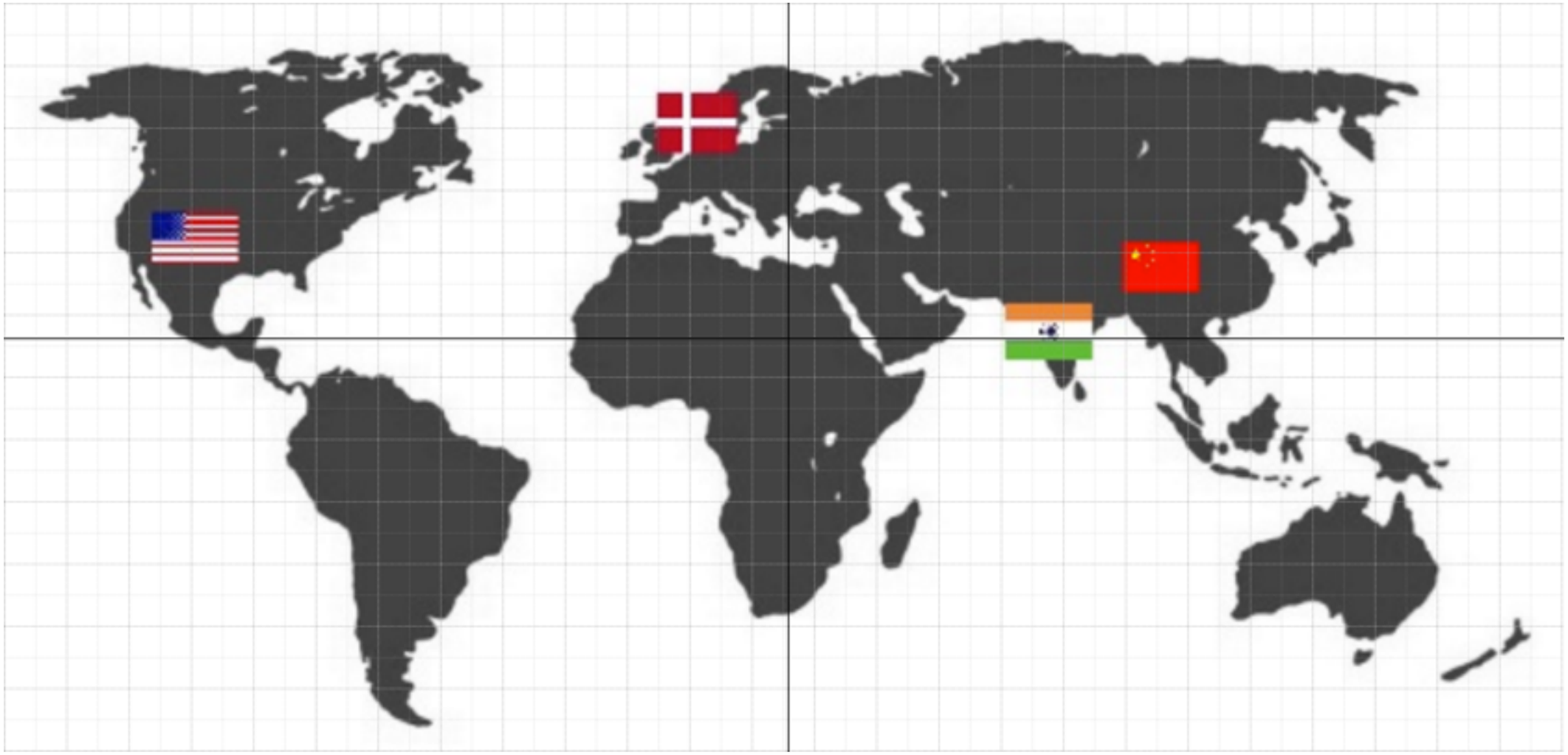
- @Carmel
- @Kroll et al.

Different kinds of distribution



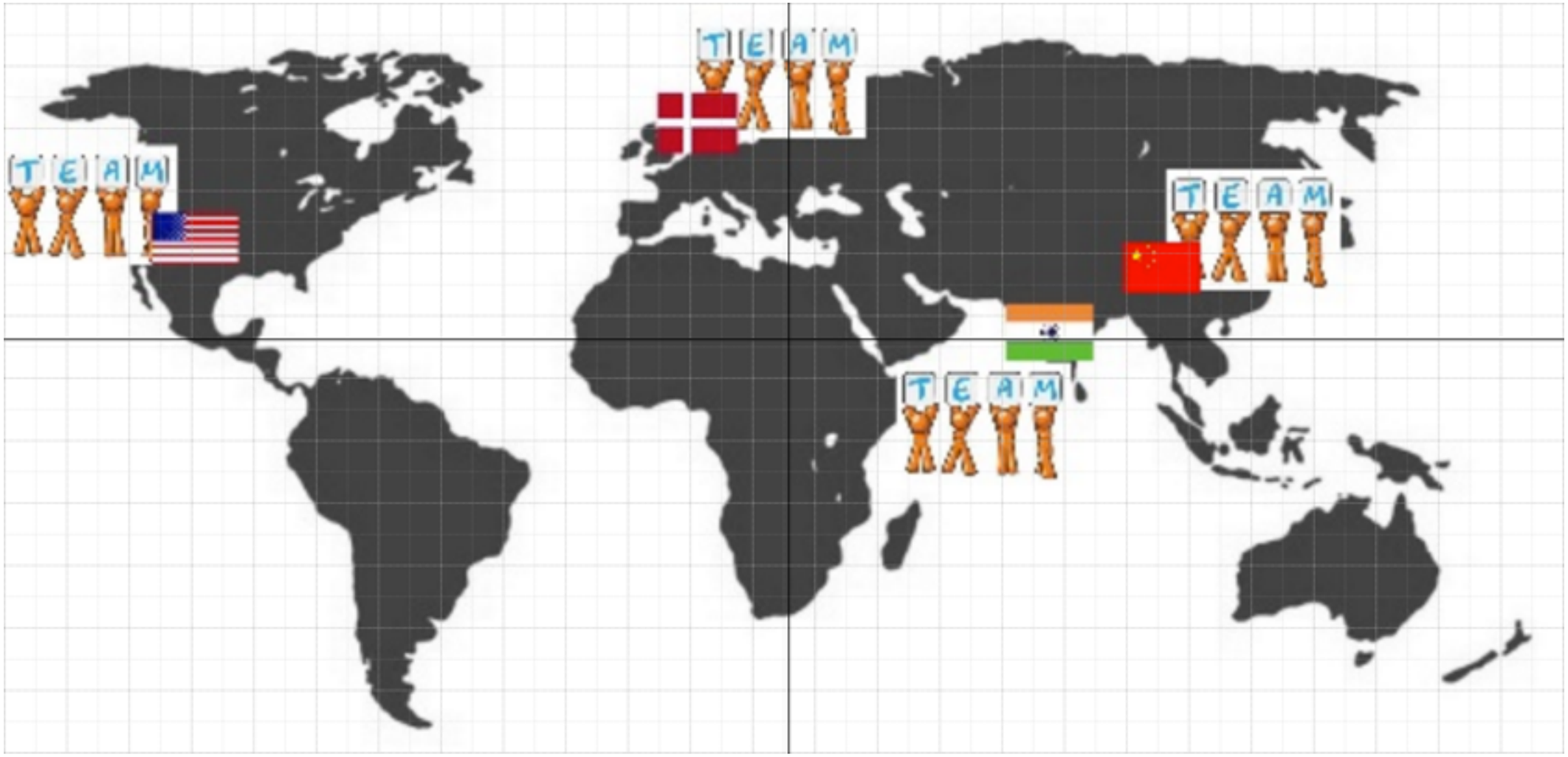
- (Globally) Distributed teams
- (Globally) Dispersed teams
- (Globally) Partially-dispersed teams

Different kinds of distribution



- Globally Distributed teams
- Globally Dispersed teams
- Globally Partially-dispersed teams

Different kinds of distribution



- **<u>Globally Distributed teams</u>**
- Globally Dispersed teams
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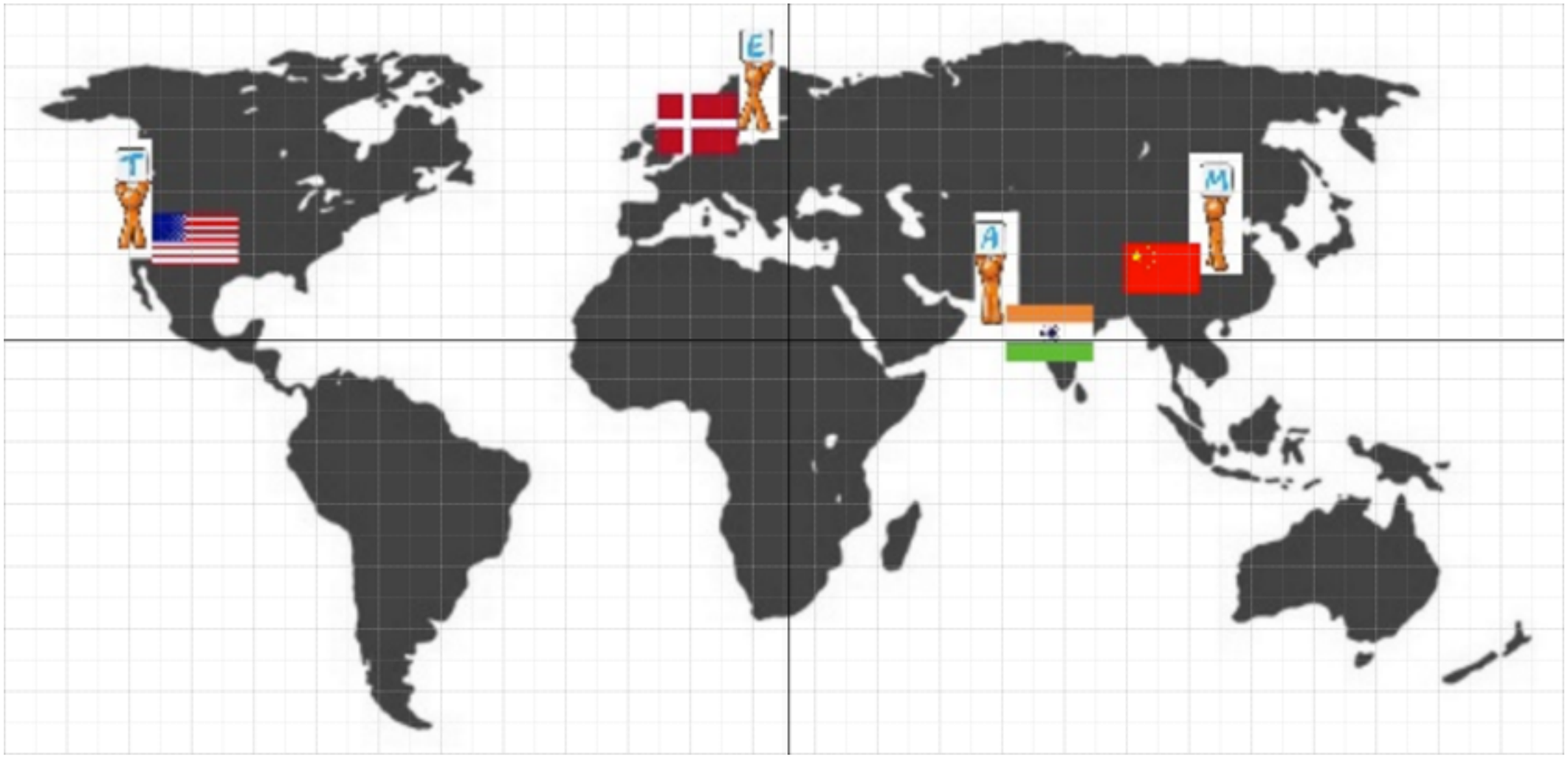
Different kinds of distribution



- Globally Distributed teams
- **Globally Dispersed teams**
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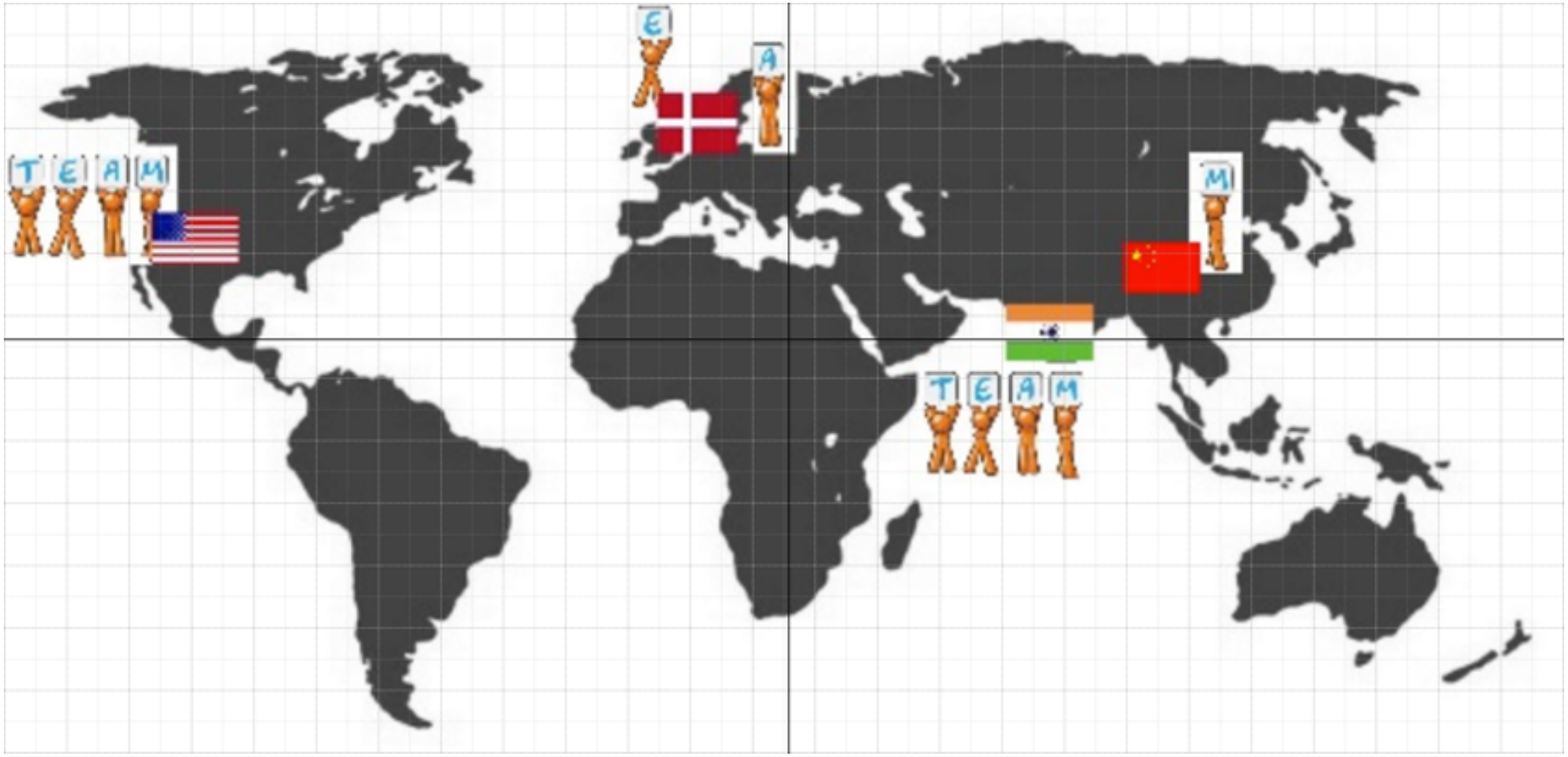
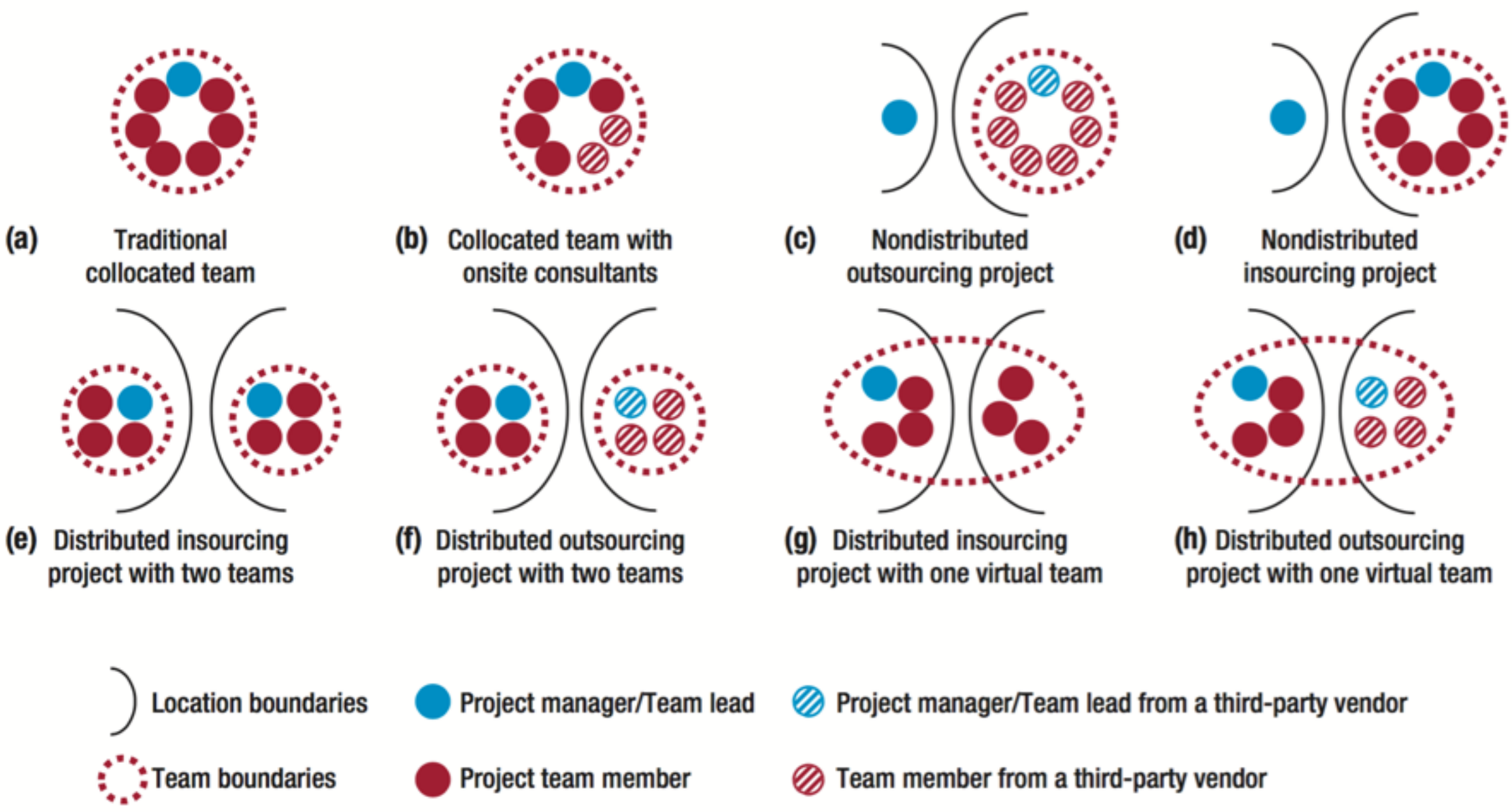
Different kinds of distribution



- Globally Distributed teams
- Globally Dispersed teams
- **Globally Partially-dispersed teams**

Virtual teams



Šmite, D., Kuhrmann, M., & Keil, P. (2014). Virtual Teams [Guest editors' introduction]. *Software, IEEE*, *31*(6), 41–46.

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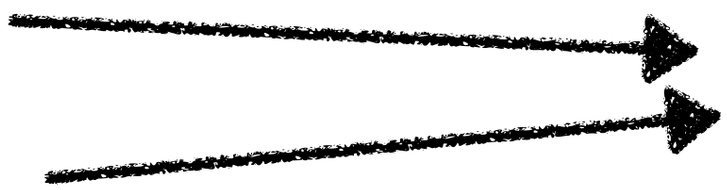
Distances in Global Software Development

- Geographical
- Temporal
- Cultural
- Linguistic



- Socio-cultural

John Noll, Beecham, S., & Ita Richardson. (2010). Global software development and collaboration: barriers and solutions. ACM Inroads.

What is culture?

"The collective programming of the mind which distinguishes the member of one human group from another."

Hofstede, G. (1980). Culture's consequences: International differences in work-related values. Sage Publications, Inc..

"A set of values and ideas that shape the behaviour."

Kroeber, A. L., & Kluckhohn, C. (1952). Culture. The Museum.

"This diversity appears in different forms such as language and ethnic differences, national and political differences, individual perceptions and motivation, and work ethics."

Deshpande, S., Richardson, I., Casey, V., & Beecham, S. Culture in Global Software Development - A Weakness or Strength? (pp. 67–76). In Proc. of the 5th IEEE International Conference on Global Software Engineering (ICGSE), 2010.

"That complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society"

Taylor, E. B. (1871). Primitive culture. 2 vols. NY: Brentano's.

- National culture
- Organisational culture
- Functional culture

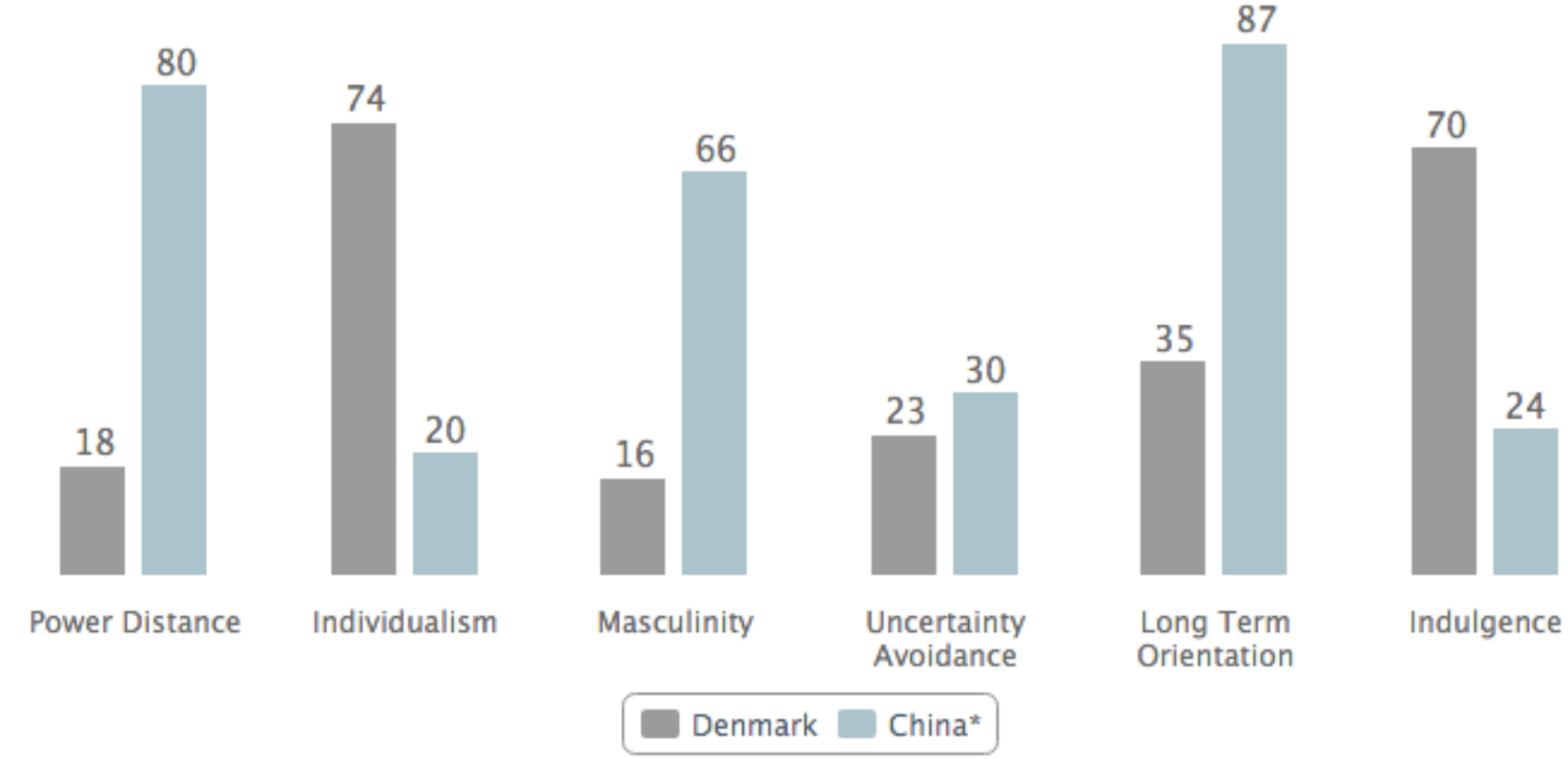
Dubé, L., & Paré, G. (2001). Global Virtual Teams. Communications of the ACM.

National Culture

- Power Distance
- Individualism versus collectivism
- Masculinity versus femininity
- Uncertainty avoidance
- Long-term versus short-term orientation
- (Indulgence)

Discussion

- *What could be the impact of cultural differences on software development?*



Source: https://geert-hofstede.com

Cultural adaptation and Negotiated culture

- Cultural adaptation
  - Different ways of working
  - Cultural norms of social behaviour, attitudes towards authority, and language issues.

- Negotiated culture
  - A compromise working culture
  - Both sides modify their work behaviours to take account of the cultural norms of their partners
  - Not achieved easily, requires time.

Impact of distances in GSD

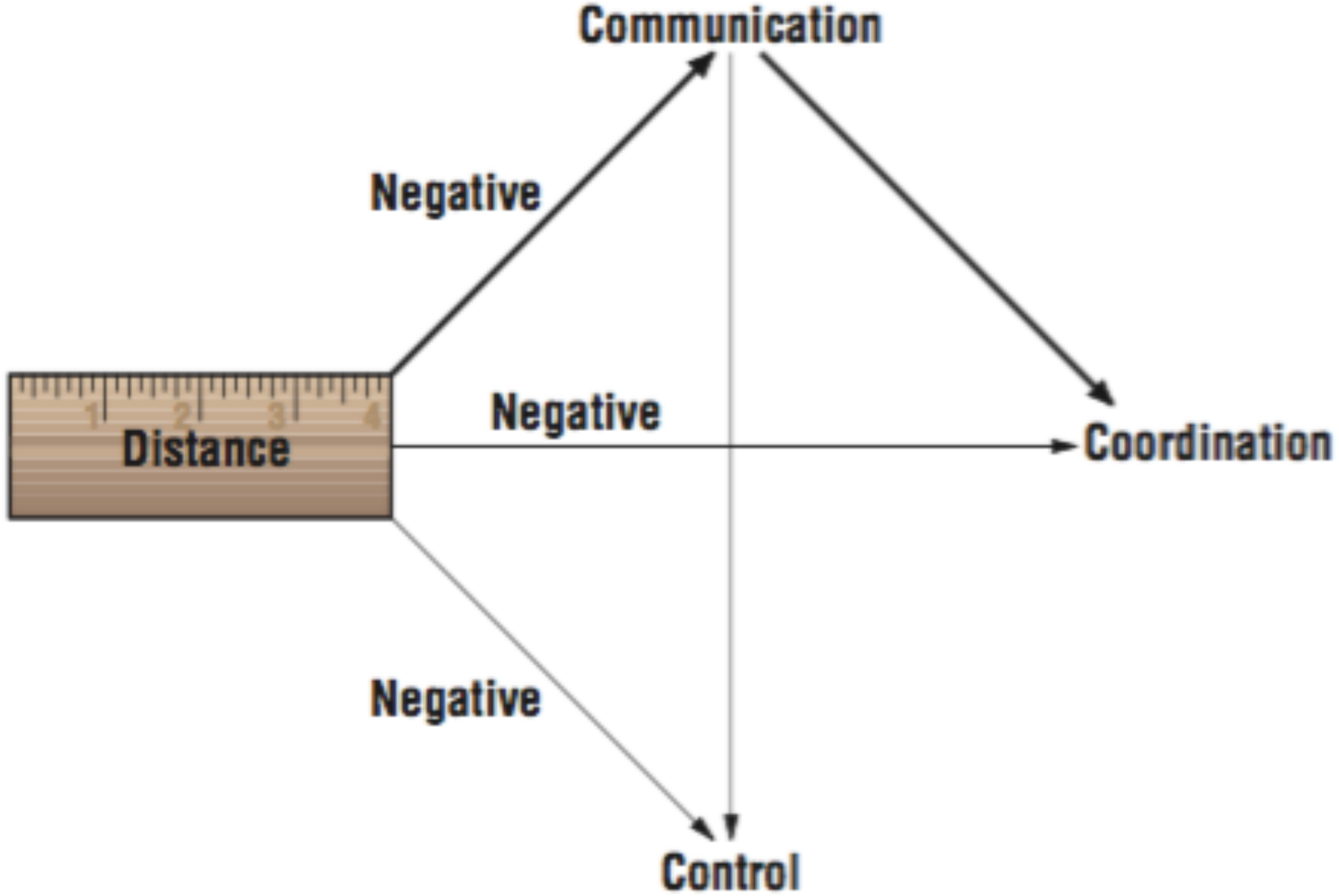
- Geographical
- Temporal
- Cultural
- Linguistic

John Noll, Beecham, S., & Ita Richardson. (2010). Global software development and collaboration: barriers and solutions. ACM Inroads.

Discussion [5']

- *Within your group come up with a list of 5 potential problems.*

Impact of distances in GSD



Carmel, E., & Agarwal, R. (2001). Tactical approaches for alleviating distance in global software development. IEEE Software.

The 3Cs

The original [Ellis et al.]

- Communication
- Collaboration
- Coordination

COMPUTING PRACTICES

GROUPWARE

Groupware reflects a change in emphasis from using the computer to solve problems to using the computer to facilitate human interaction. This article describes categories and examples of groupware and discusses some underlying research and development issues. GROVE, a novel group editor, is explained in some detail as a salient groupware example.

SOME ISSUES AND EXPERIENCES

C.A. Ellis, S.J. Gibbs, and G.L. Rein

Society acquires much of its character from the ways in which people interact. Although the computer in

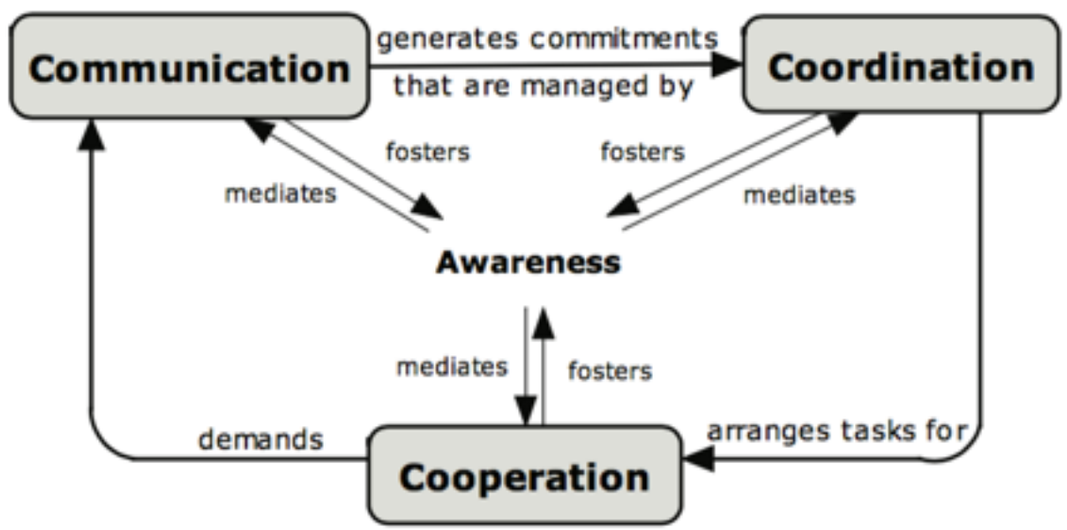
laboration of many specialists, including social scientists and computer scientists, CSCW looks at how groups work and seeks to discover how technology (especially computers) can help them work.

Commercial CSCW products, such as The Coordinator™ 4041 and

in this larger sense and delineates classes of design issues facing groupware developers. It is divided into five main sections. First, the **Overview** defines groupware in terms of a group's common task and its need for a shared environment. Since our definition of

The 3C collaboration model [Fuks et al.]

- Communication
- Coordination
- Cooperation



Sources:

Clarence A Ellis, Simon J Gibbs, & Gail Rein. (1991). Groupware: some issues and experiences. *Communications of the ACM.*

Fuks, H., Raposo, A., Gerosa, M. A., Pimentel, M., & Lucena, C. J. P. (2007). The 3c collaboration model. The Encyclopedia of E-Collaboration.

Impact of distances in GSD

	Temporal distance	Geographical distance	Socio-cultural distance
Communication	• Reduced opportunities for synchronous communication	• Face-to-face meetings difficult	• Cultural misunderstandings
Coordination	• Typically increased coordination costs	• Reduced informal contact can lead to lack of critical task awareness	• Inconsistent work practices can impinge on effective coordination • Reduced cooperation arising from misunderstandings
Control	• Management of project artefacts may be subject to delays	• Difficult to convey vision and strategy • Perceived threat from training low-cost "rivals"	• Different perceptions of authority can undermine morale • Managers must adapt to local regulations

Lanubile, F. (2009). Collaboration in distributed software development. International Summer School on Software Engineering, ISSSE.

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Tactical approaches for alleviating distance in Global Software Development

- Tactic 1: Reduce intensive collaboration
- Tactic 2: Reduce cultural distance
- Tactic 3: Reduce temporal distance

Carmel, E., & Agarwal, R. (2001). Tactical approaches for alleviating distance in global software development. IEEE Software.

Tools for alleviating distance in Global Software Development

Computer-Mediated Support Necessary for Given SE Arrangement	Single Site	Multiple Sites
Single Person	CASE Tools Automation Tools	
Several People	+ Collaboration Tools	+ Coordination Tools + Communication Tools + Awareness Tools

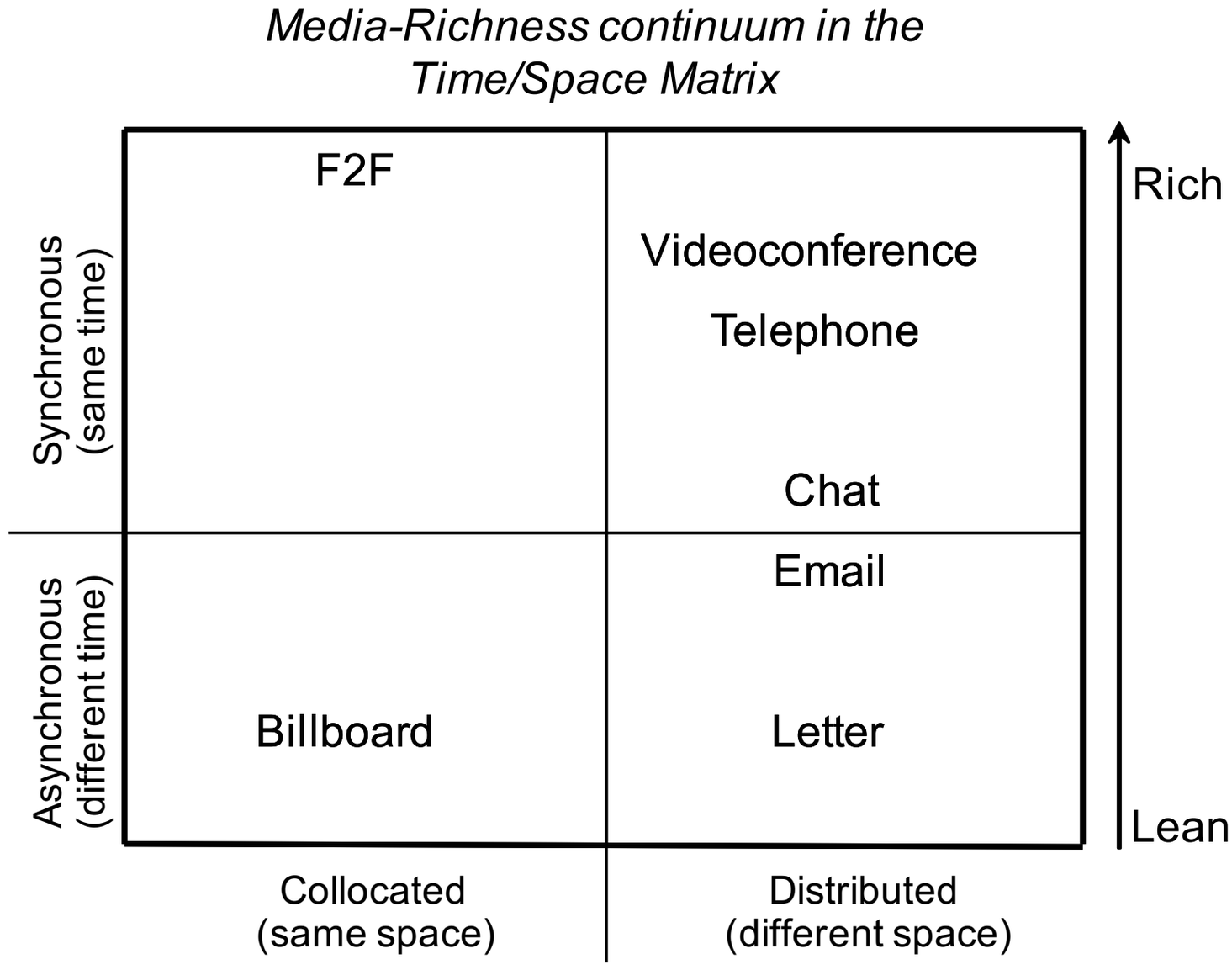
Tools for alleviating distance in Global Software Development

- Software configuration management
- Bug and change tracking
- Build and release management
- Knowledge centre (e.g., wikis)
- Collaborative development environments (CDE)
- Communication tools

Computer-Mediated Communication (CMC)

Media can be characterized along three dimensions of information exchange:

- Time (when)
- Space (where)
- Richness (how much)



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Tools approach for alleviating distance in Global Software Development

	Temporal distance	Geographical distance	Cultural distance	Linguistic distance
Communication				
Coordination				
Collaboration				
Awareness				

Exercise [15']

- *Within your group come up with at least a few candidates per block.*

Process approach for alleviating distance in Global Software Development

- Formal versus Informal
- Waterfall versus Agile

Formal in Global Software Development

- Tactic 1: Reduce intensive collaboration
- Tactic 2: Reduce cultural distance
- Tactic 3: Reduce temporal distance

- Increase formal documentation
- Increase organisational factors such as processes, structure, and goal alignment
- Waterfall approach

Herbsleb, J., & Moitra, D. (2001). Global software development. IEEE Software.

Agile in Global Software Development

- GSD
  - Lack of informal communication due to geographical distance and time-zone differences
  - Difficulties with division of work
  - Project and process management issues
  - Infrastructure problems

- Agile
  - Close collaborations
  - Frequent informal face-to-face communication rather then heavy documentation
  - Self-organizing teams
  - Peripheral awareness
  - Physical artifacts

Agile GDS: dispersed agile team

- There were some overlapping working hours among team members, so *synchronous communication* and *collaboration* was possible (IM, videoconference, phone)
- Team members adapted their working hours to those of remote colleagues
- They were recording the meetings to share them asynchronously
- Communication was mainly informal
  - impromptu conversations
  - collaborating on a daily basis with some remote colleagues



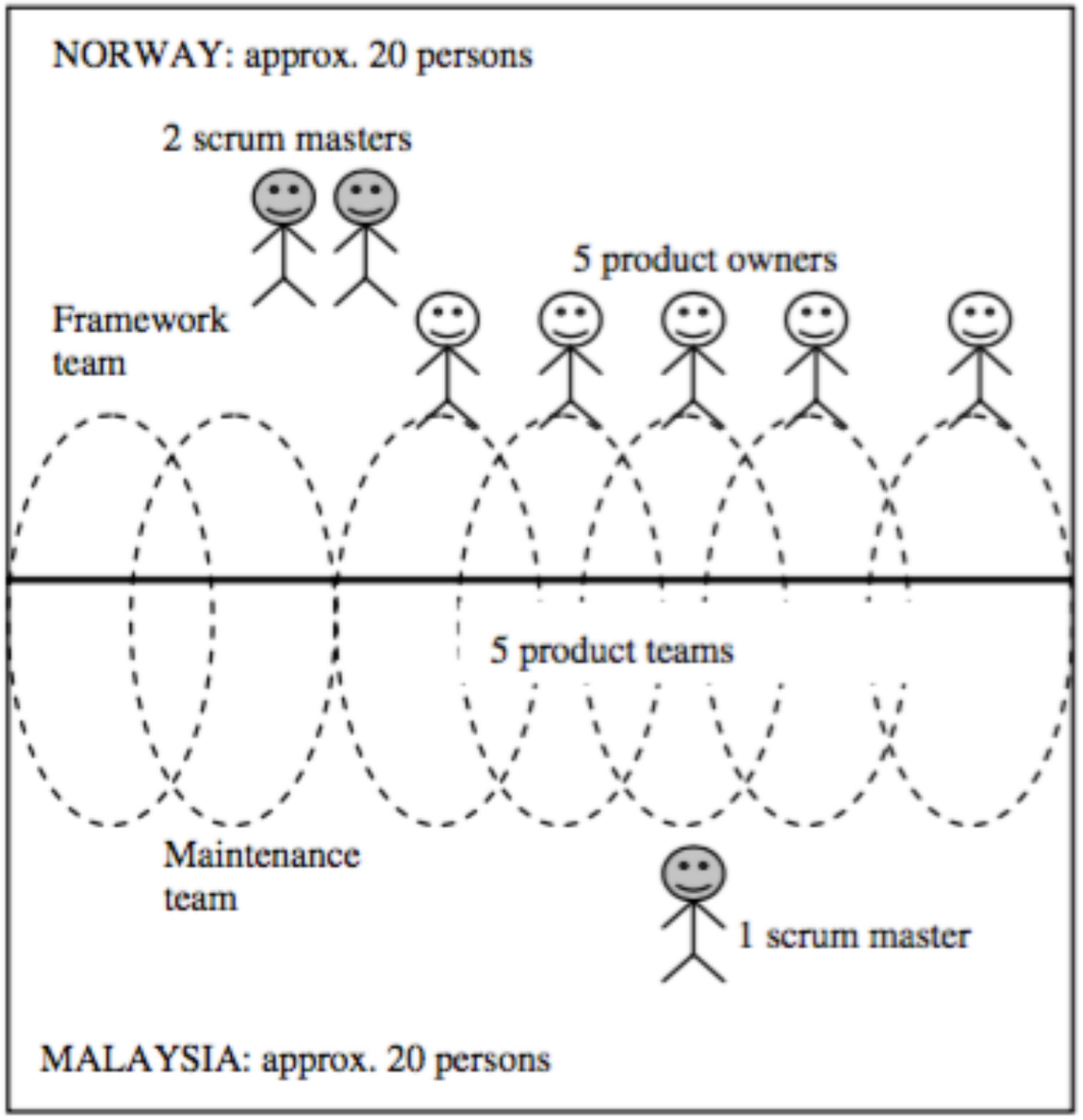
Sharp, H., Giuffrida, R., & Melnik, G. Agile Processes in Software Engineering and Extreme Programming: 13th International Conference, XP 2012.

Agile GDS: using Scrum in large projects

- A case study on agile practices in a 40-person development organisation distributed between Norway and Malaysia.

- Scrum practices were successfully applied:
  - using teleconference and web cameras for daily scrum meetings
  - synchronised 4-week sprints and weekly scrum-of-scrums

- Additional agility supporting practices for distributed projects were identified
  - frequent visits
  - unofficial distributed meetings
  - annual gatherings



M Paasivaara, S Durasiewicz, & C Lassenius. (2008). Using scrum in a globally distributed project: a case study. Software Process: Improvement and Practice.

What about Outsourcing and Open Source?

- Global Software Development
- Global Software Engineering
- Distributed Software Development
- Distributed Software Engineering
- Multi-site software development
- …
- Offshoring
- Outsourcing
- Open source

From Offshore Outsourcing to Offshore Insourcing

- Three Scandinavian medium-sized software companies that have terminated their offshore outsourcing relationship and changed to offshore insourcing arrangements were investigated.

- What are the reasons for terminating offshore outsourcing relationship?
  - Disappointing low quality of the software delivered, being caused by insufficient domain knowledge, high turnover, and lack of motivation among the remote and external developers

- What are the reasons for switching from offshore outsourcing to offshore insourcing?
  - Offshore insourcing helped to address many challenges experienced in outsourcing, although some of them remained
  - Larger control over recruitment, motivation, and leadership
  - Access to new technology and new market.

Moe, N. B., Šmite, D., Hanssen, G., & Barney, H. (2013). From offshore outsourcing to insourcing and partnerships: four failed outsourcing attempts. Empirical Softw. Engineering

Summary

- What is Global Software Development?
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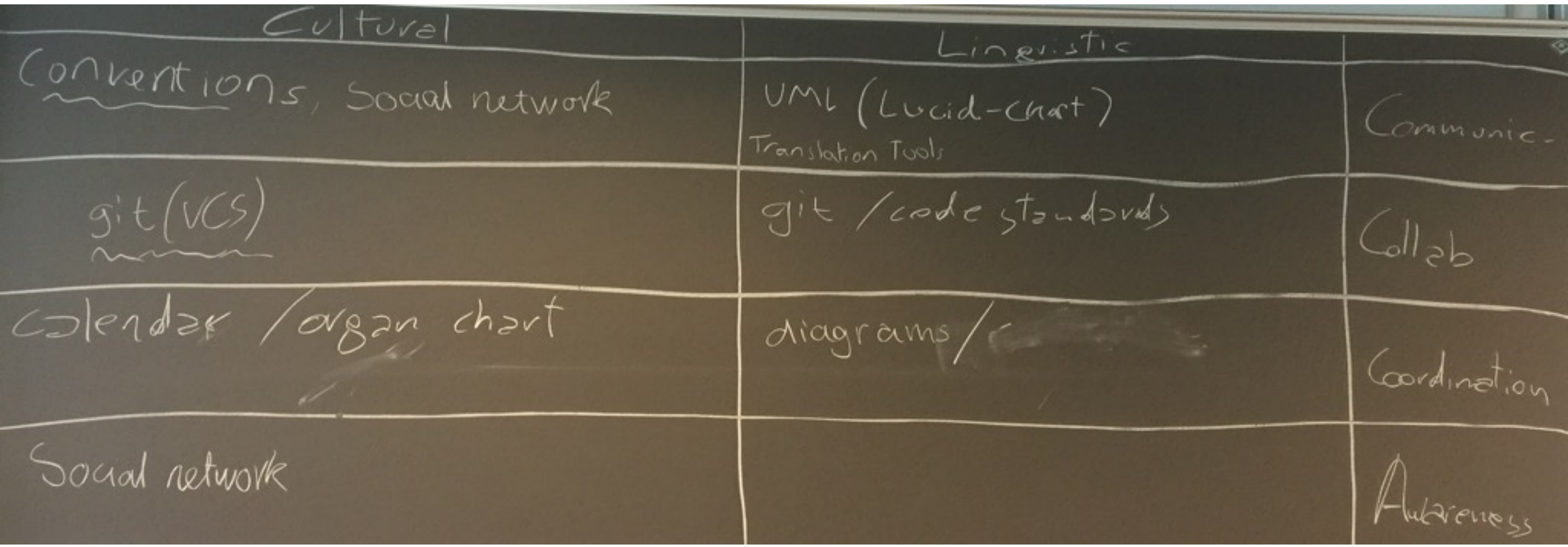
- Acknowledgement: partial material from this lecture has been provided by Rosalba Giuffrida

From the lecture



From the lecture