A Coordination Framework for Pervasive Applications in Multi-User Environments

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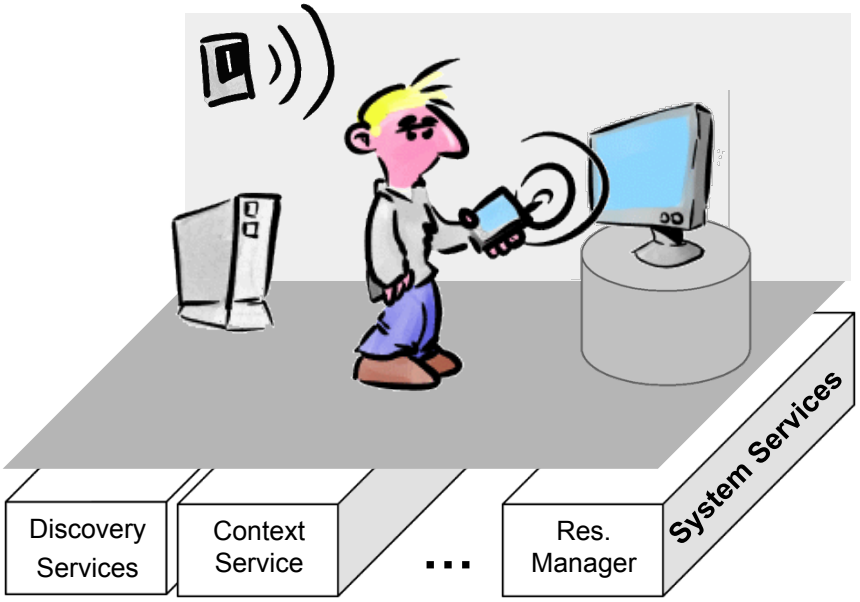
Agenda

- Pervasive Computing Environments
- Interferences
- Coordination Framework
- PCOM
- Conclusion and Future Work

Pervasive Computing Environment

Smart environments

- spatially limited area
- infrastructure with fixed set of networked devices
- functionality is provided through the execution of *pervasive applications*

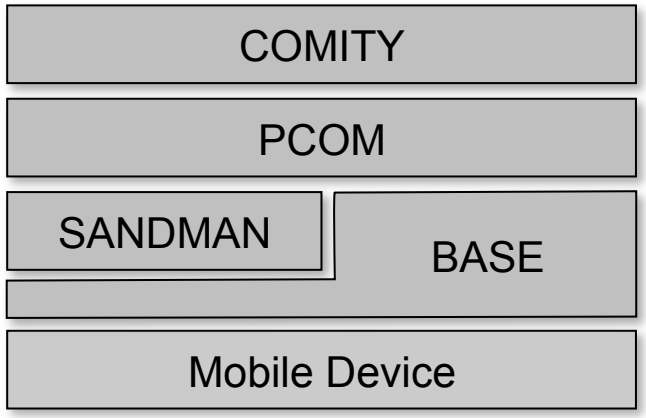


Pervasive Applications

- distributed applications
- make use of currently available resources
- context-interactive
  - context-aware → depends on a certain context
  - context-altering → influences a certain context

3PC: System-support for P2P Pervasive Computing

- **Goal:** Adaptive system software for Pervasive Computing
- Adaptation on multiple levels
  - BASE: network level
  - SANDMAN: system level
  - PCOM: application level
  - COMITY: context level



- In addition: common system services, e.g.
  - Smart Peer Group Management
  - Context Management

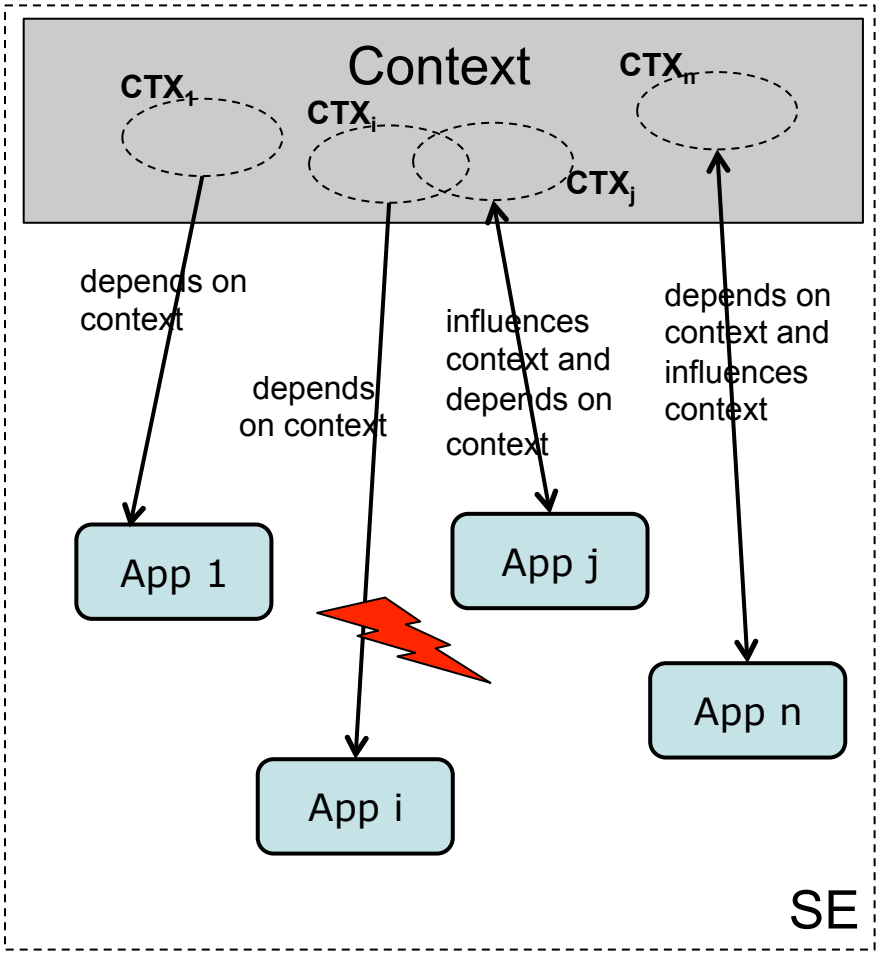
Context Interference in Multi-User Environments

- Applications share a common context (the physical environment they act in)

  → they are directly related with each other

- But: applications adapt the context according to their needs irrespective of other applications

➡ ***Context Interferences*** occur

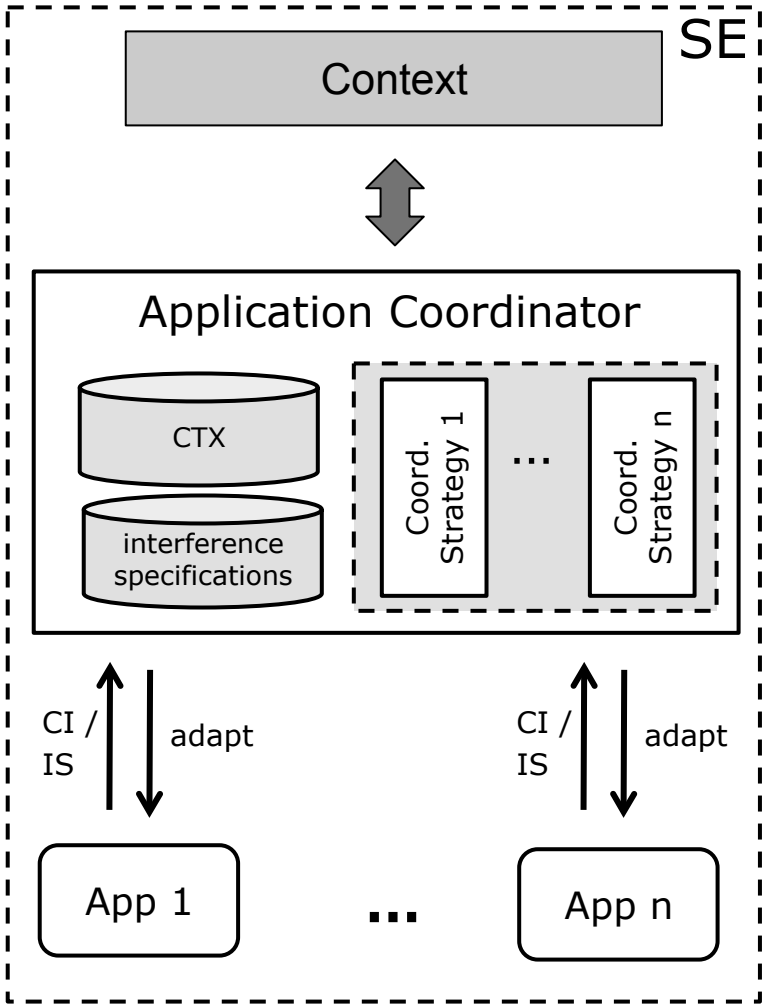


Coordination Framework

Goal: Coordinate the use of context to handle interferences

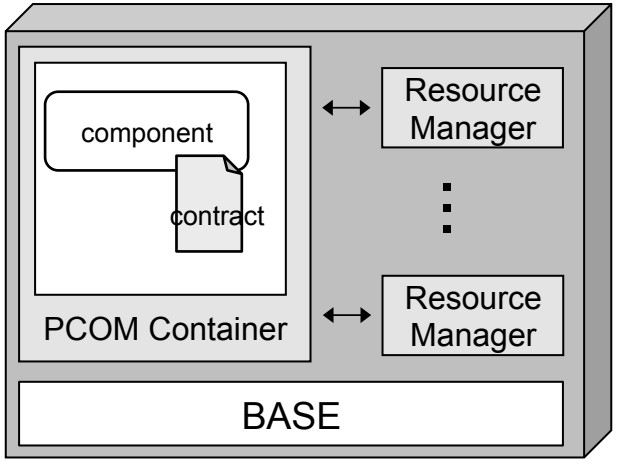
Basic idea:

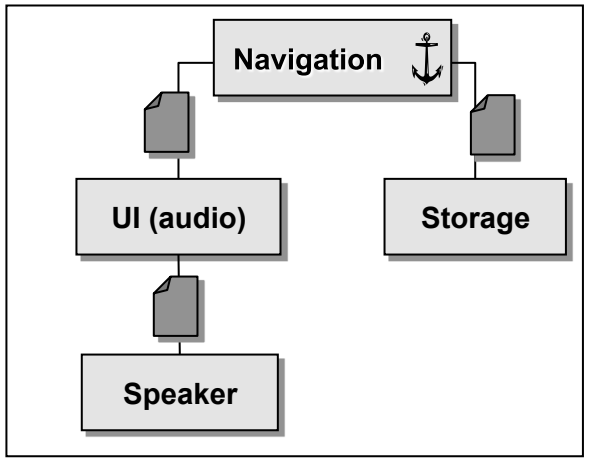
- Each application explicitly states
  - *Interference specification (IS)*
  - *Context Influences (CI)*
- Application coordinator monitors for interferences, if CTX satisfies set of IS
- Application coordinator resolves interference by inducing the adaptation of affected applications according to a coordination strategy



PCOM

- Composes applications from available software components at runtime
- Dependencies are specified in *contracts*
- PCOM application model = application tree
- *Contract negotiation* by *PCOM container*
- Resources are allocated to components by *Resource Managers*
- All dependencies are resolvable = application is executable
- *Adaptation* if sub-trees become unavailable or new sub-trees become available





PCOM application tree

Application Coordination for PCOM

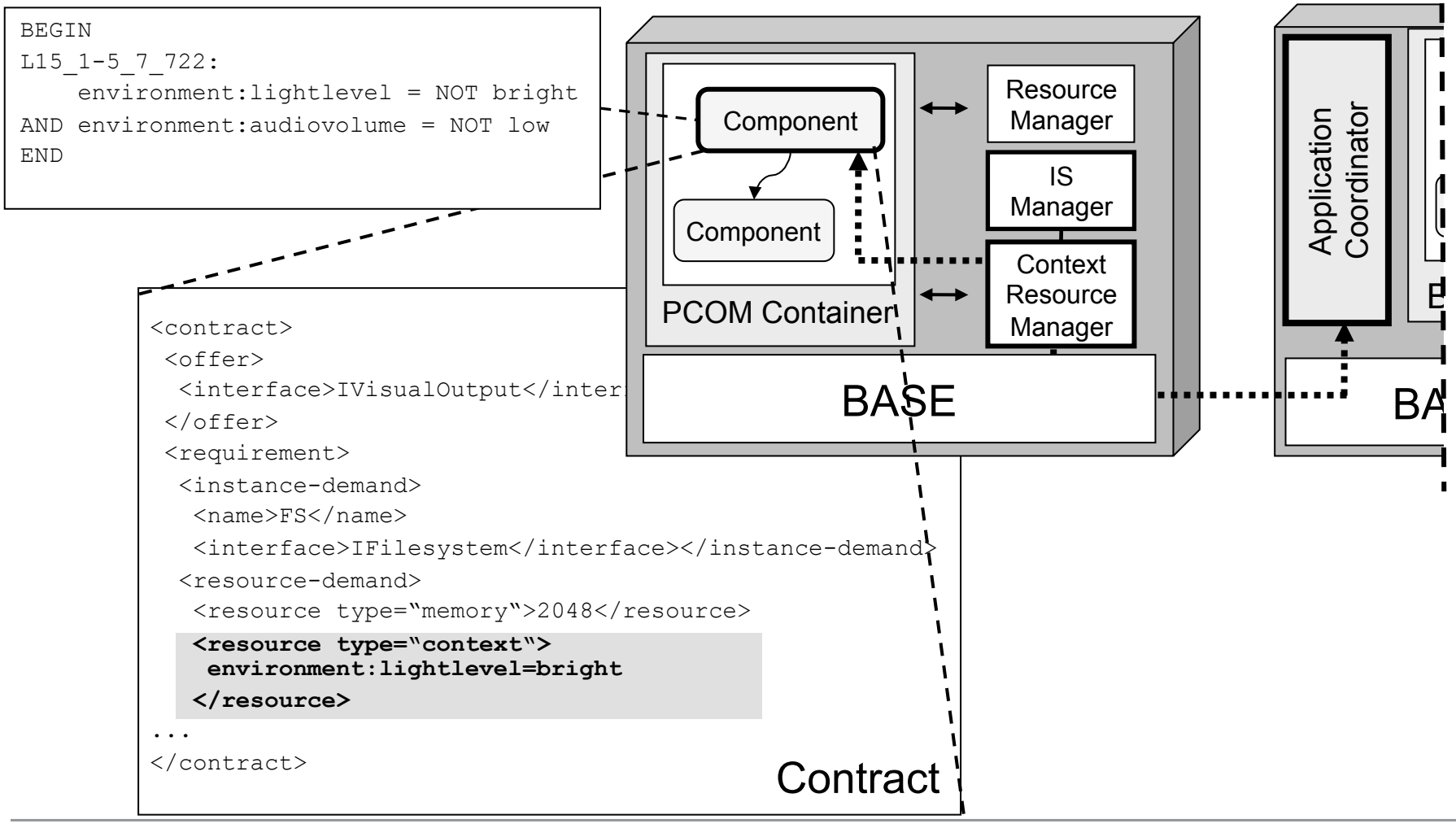
Basic idea:

- Physical environment = set of *context resources*

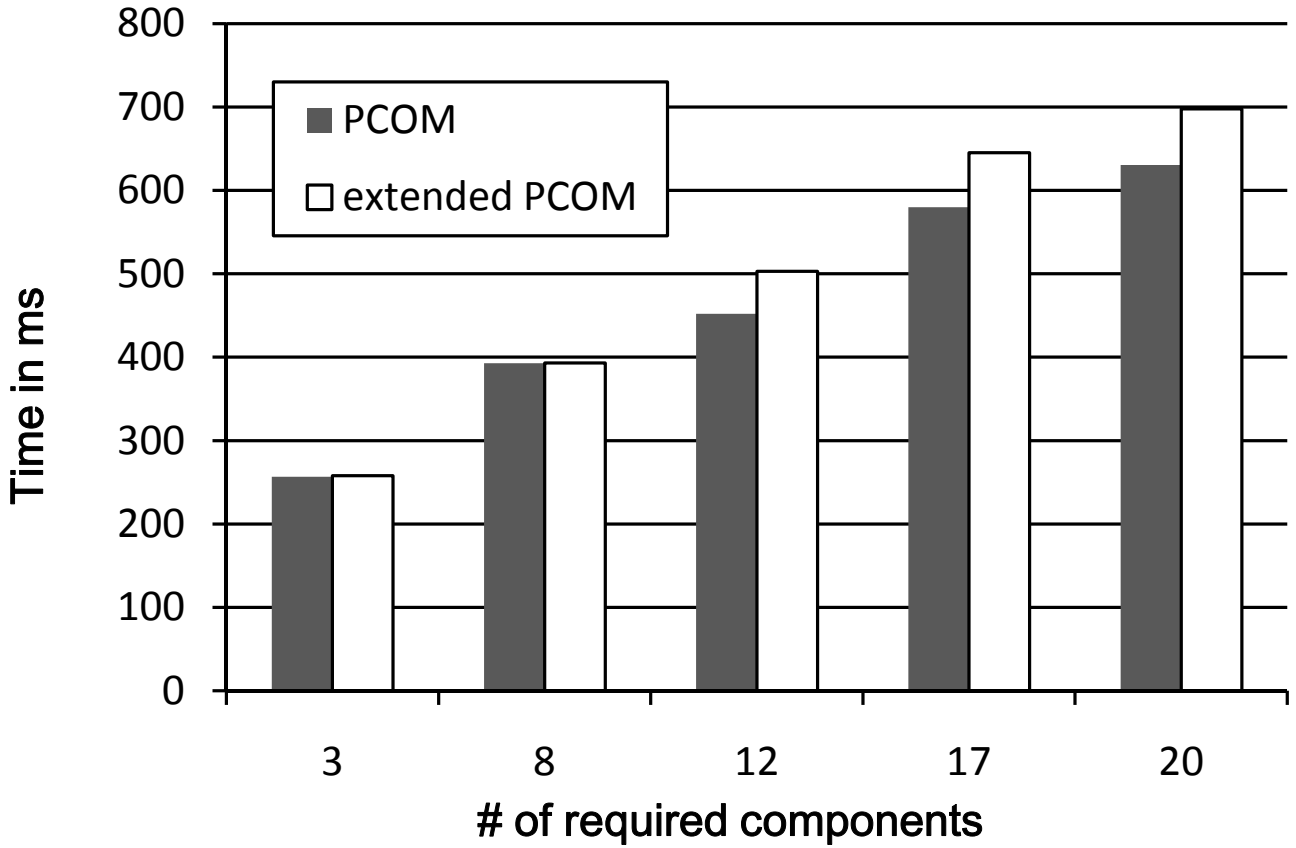
  → A context resource reflects an effect on the physical environment

- Applications must allocate context resources if their execution has an impact on the context
- Application coordinator acts as a central context resource manager
- Interference specifications constrain the use of context resources for others

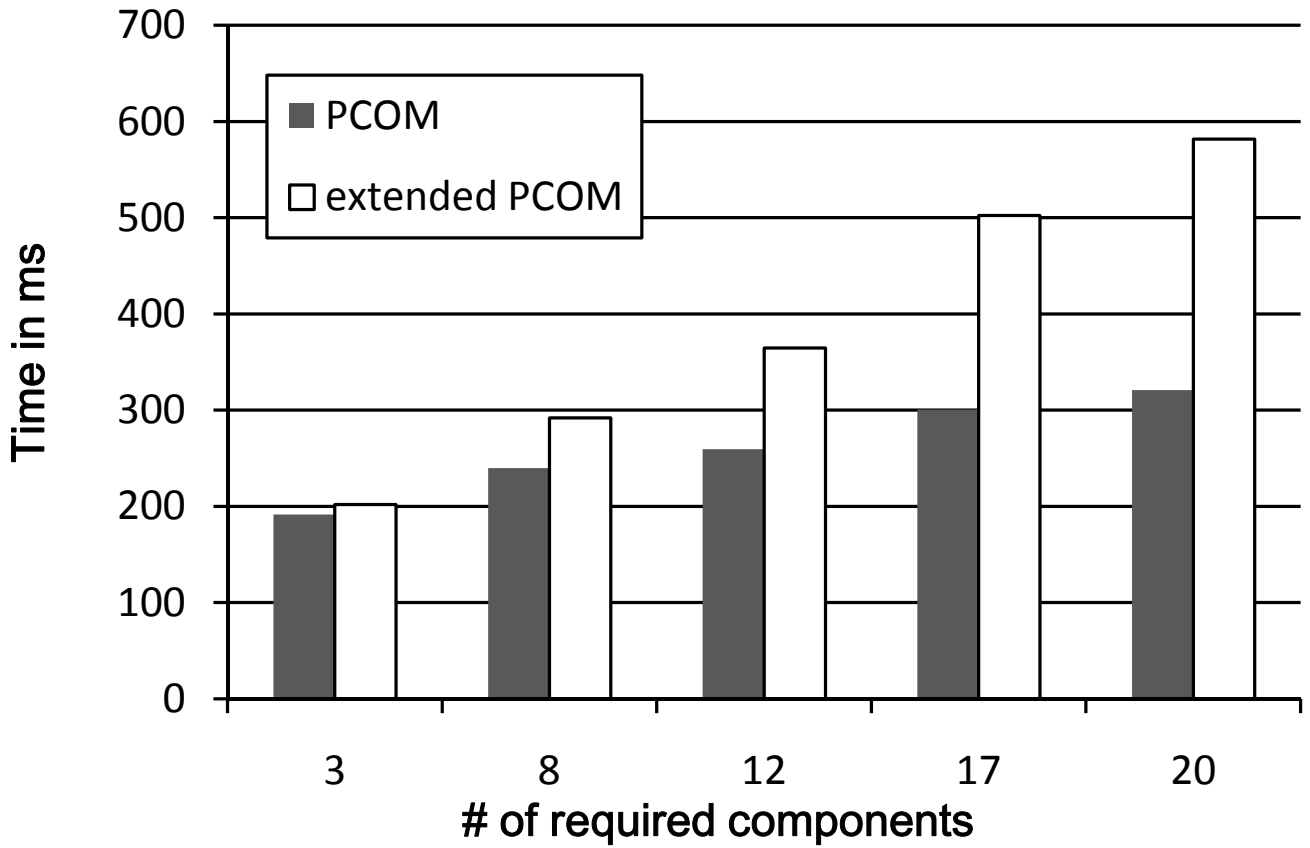
PCOM Extensions for Application Coordination



Evaluation: Height



Evaluation: Width



Conclusion and Future Work

Conclusion

- Framework for coordinating pervasive applications
  - Context is handled as “context resources” – managed by the application coordinator
  - Use of resources is constrained by interference specifications
  - Context interferences are resolved by using built-in adaptation mechanism

Future work

- Coordination for smart peer groups
- More sophisticated coordination strategy

Thank you for your attention!