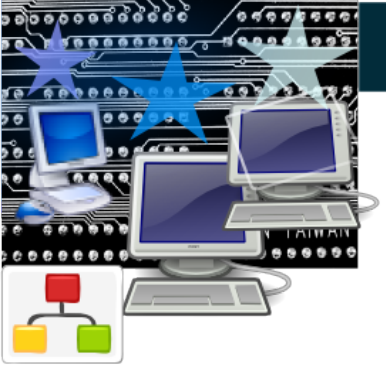

Towards PaaS and Clouds Our experience with BonjourGrid and PastryGrid – AOC Team –

Christophe Cérin[1]

[1]Université de Paris XIII, CNRS UMR 7030, France

Bi-lateral China-France workshop

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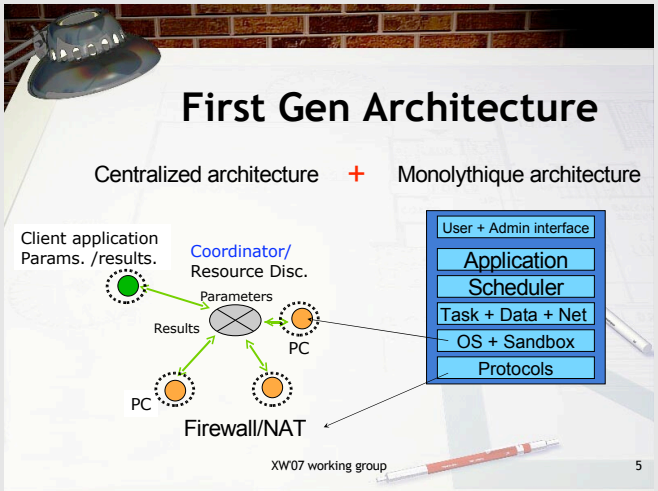
Objectives

1. Motivate research projets in Grids & Clouds ;
2. Starting from recent advances in Desktop Grid Middleware:
   - BonjourGrid (orchestration of multiple instances of DG middleware) and PastryGrid (fully distributed execution of applications)
   - Joint works with UTIC lab., Tunisia (Heithem Abbes and Mohamed Jemni)
3. Before keeping innovative ideas to reuse in Cloud Architectures / Systems:
   - decentralized architectures and services;
   - large scale systems (FT);
   - interoperability of services (the client is not a prisonner, or if it is, he can choose his prison(s)!)

Desktop Grid Architectures

Desktop Grid



Key Points

- Federation of thousand of nodes;
- Internet as the communication layer: no trust!
- Volatility; local IP; Firewall

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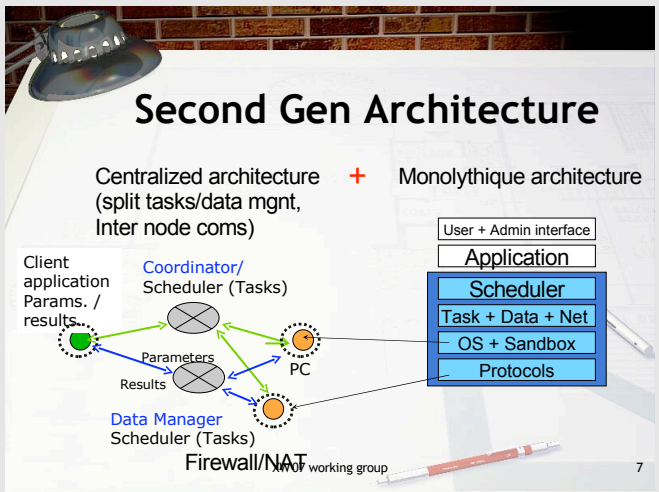

Future Generation (in 2006)

- Distributed Architecture
- Architecture with modularity: every component is "configurable": scheduler, storage, transport protocole
- Direct communications between peers;
- Security;
- Applications coming from any sciences (e-Science applications)

In search of distributed architecture

First line: publish/subscribe system to notify and coordinate services and multiple DG without a central broker ⇒ BonjourGrid;

Second line: approach based on structured overlay network to discover (on the fly) the next node executing the next task ⇒ PastryGrid;

(main contributions of Heithem Abbes in his PhD)

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- Each coordinator searches, in a concurrent way, participants (idle machines)

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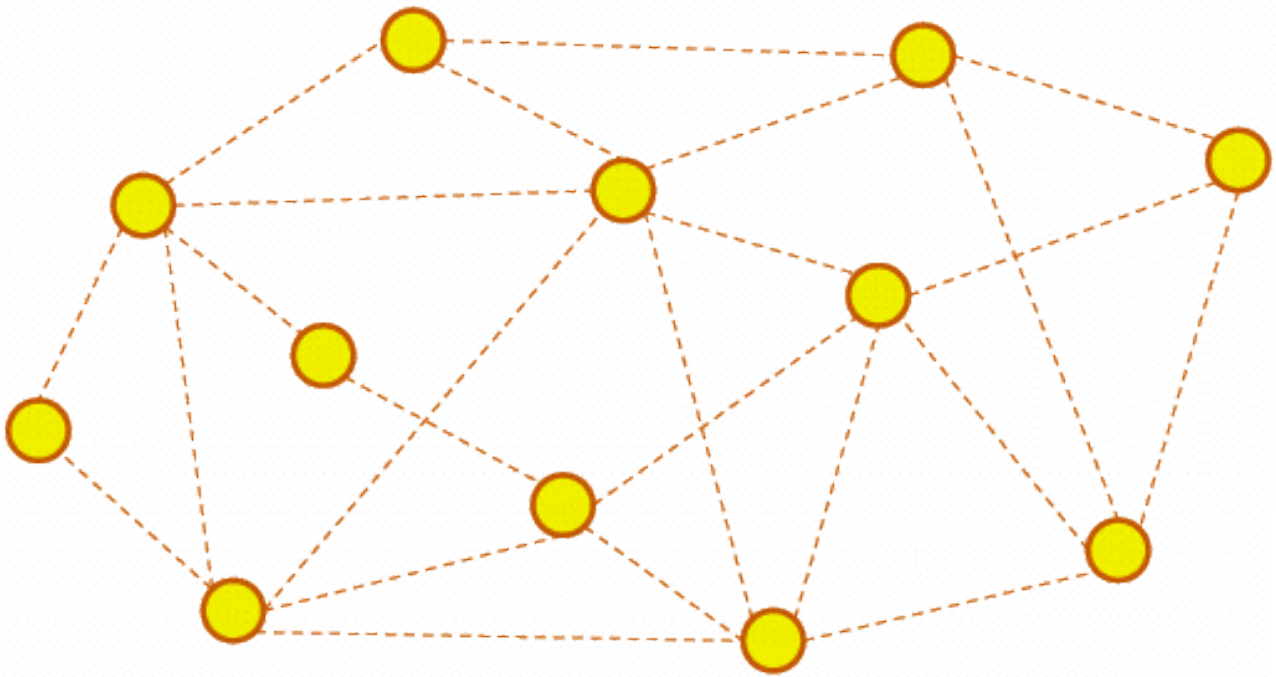

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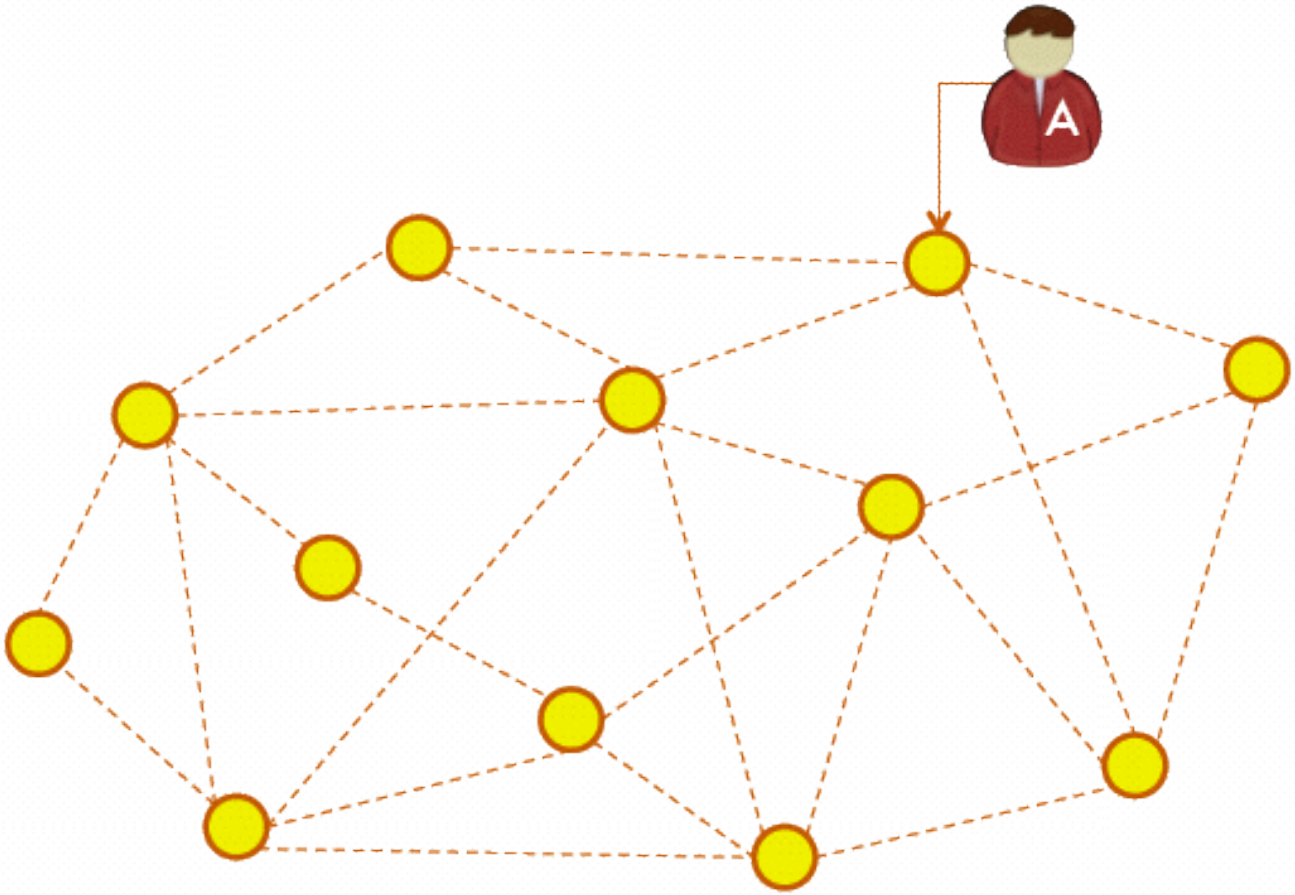

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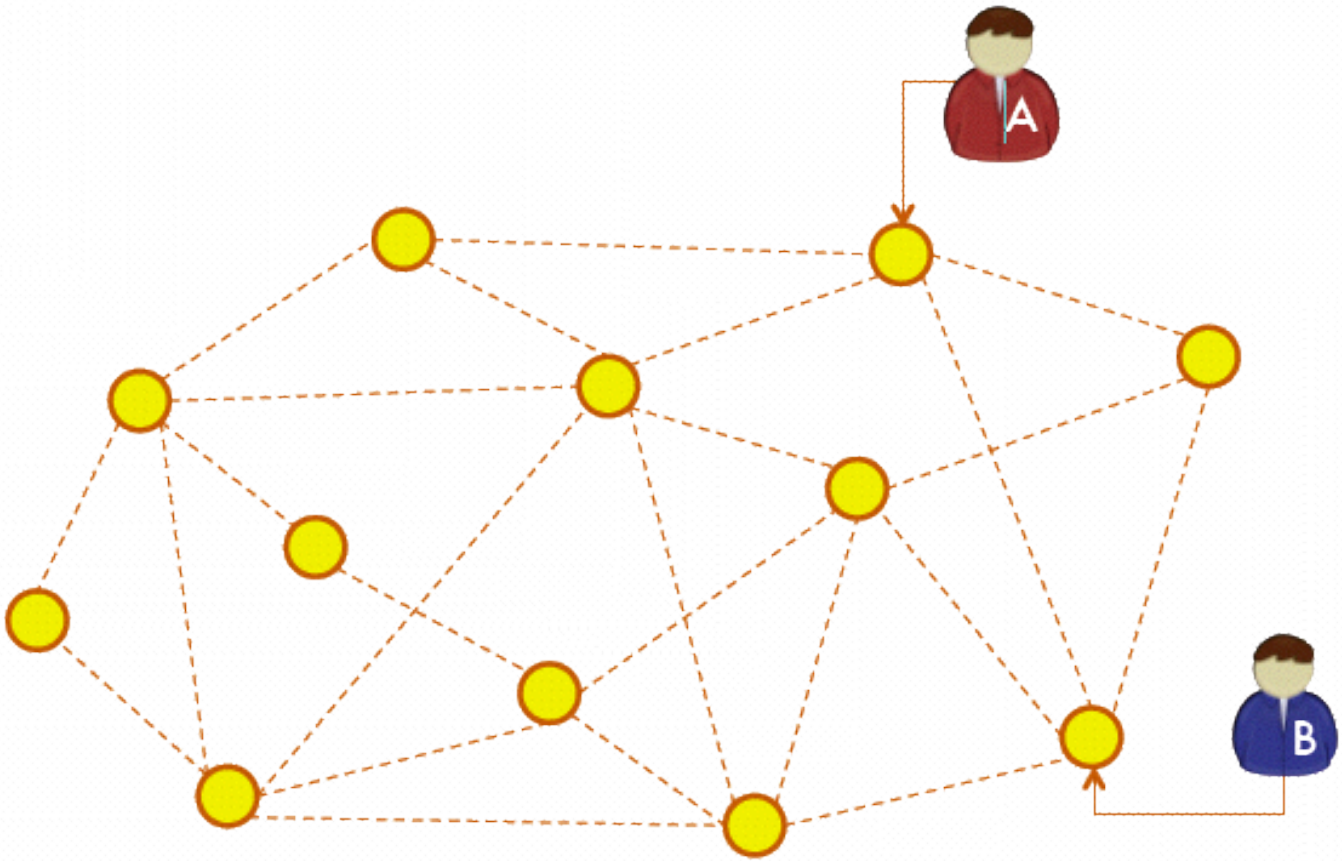

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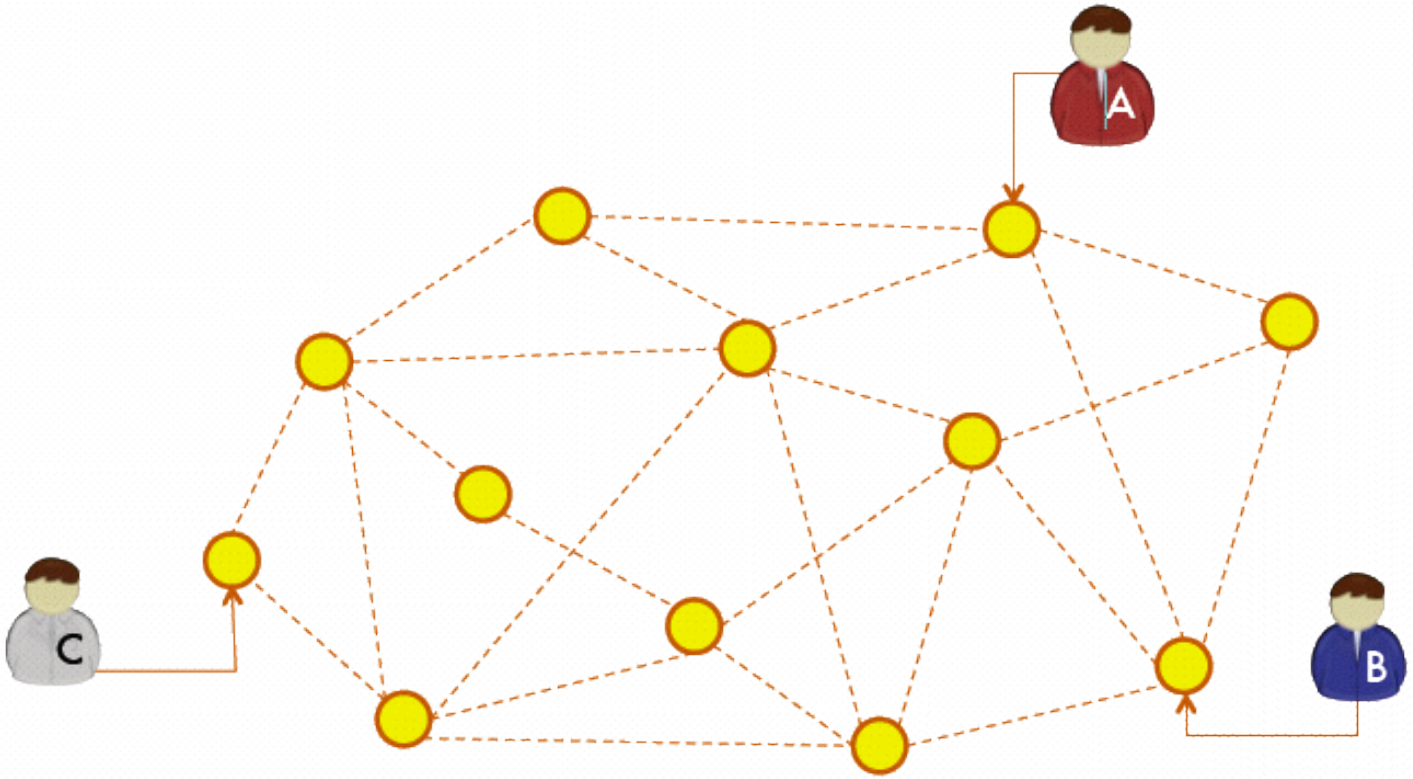

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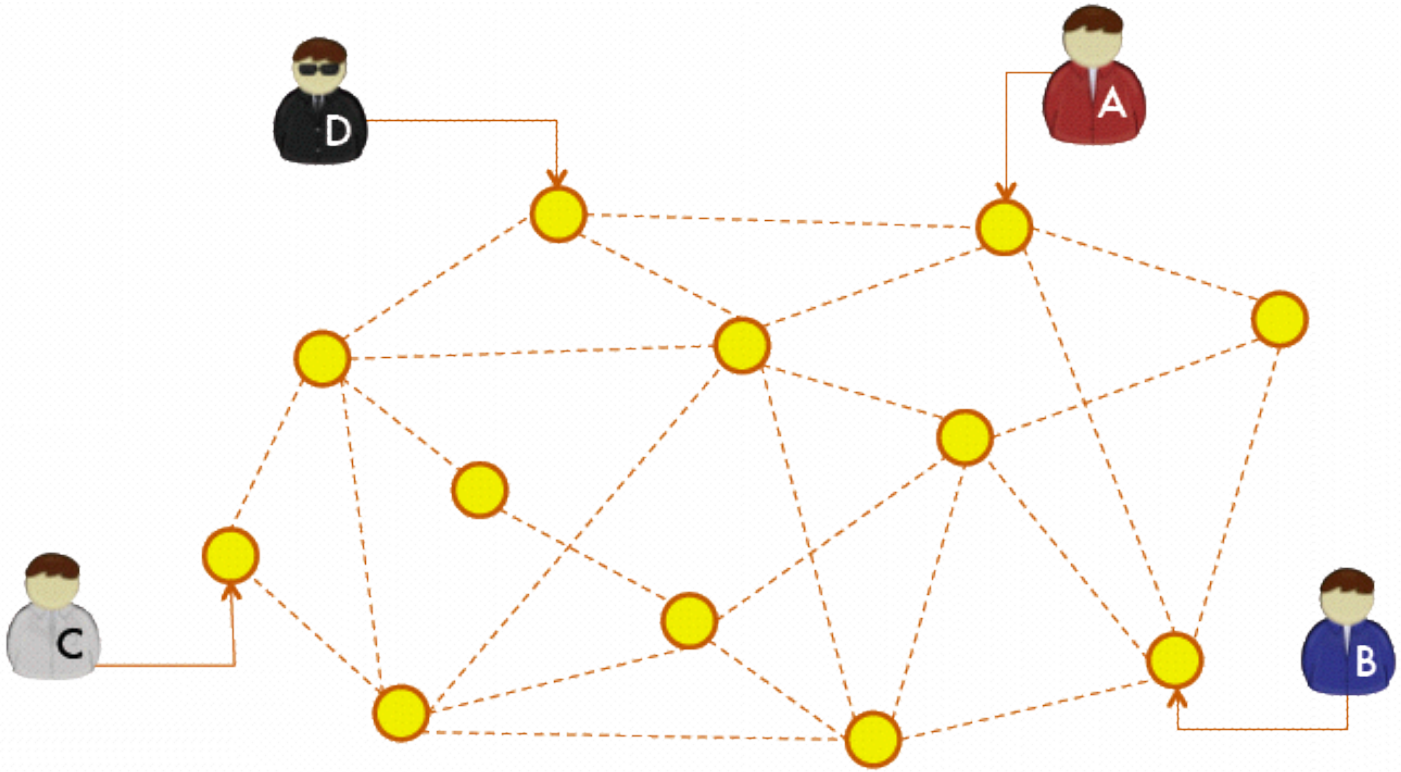

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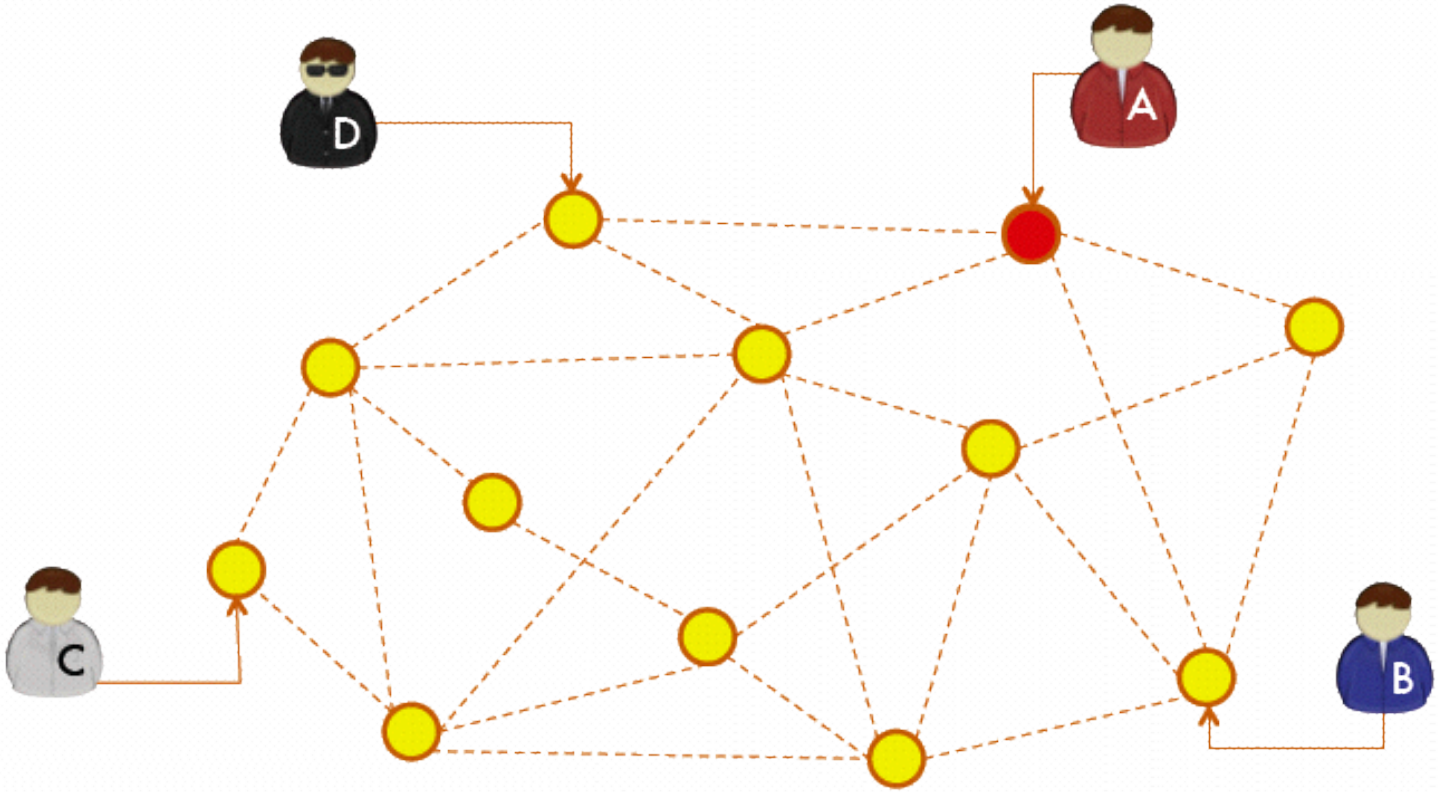

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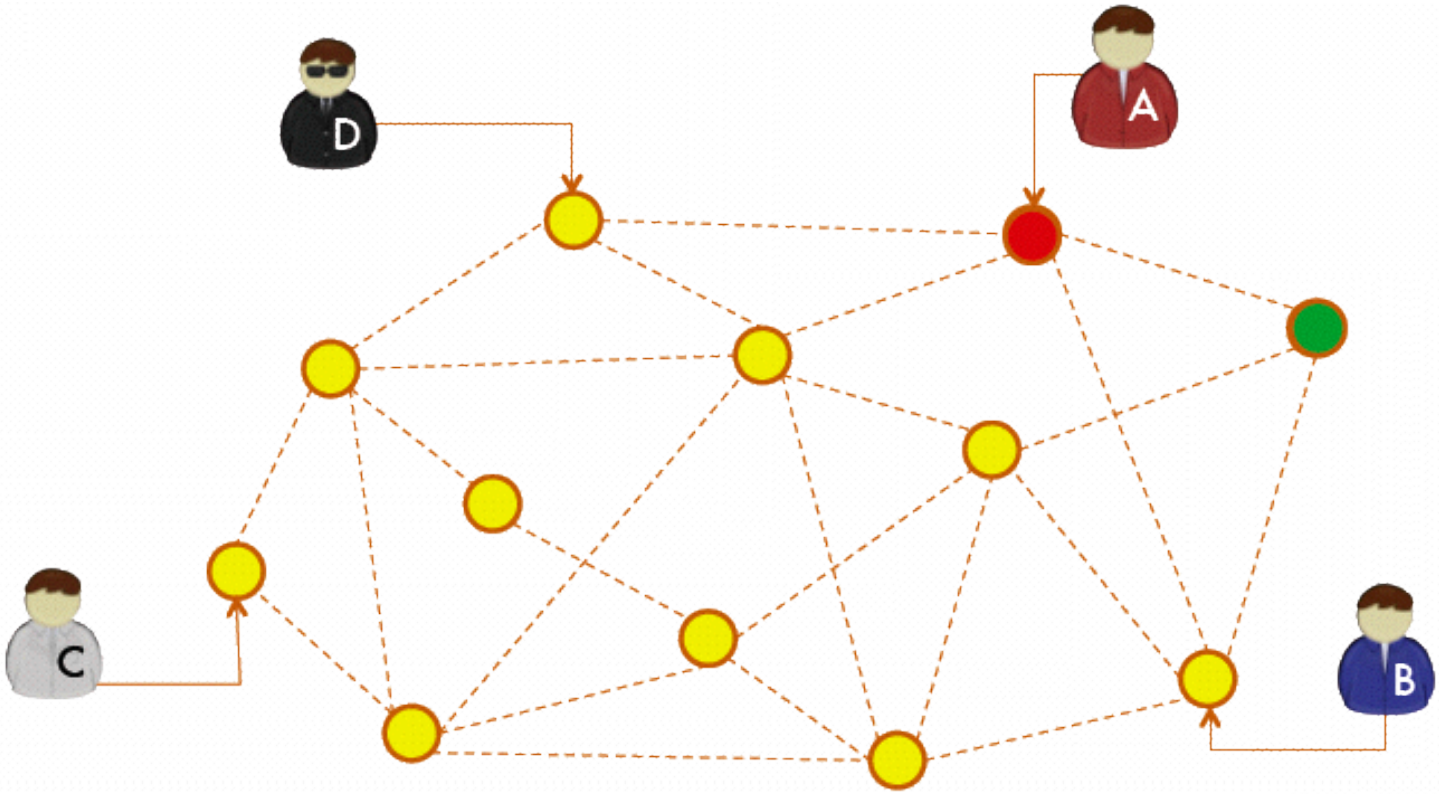

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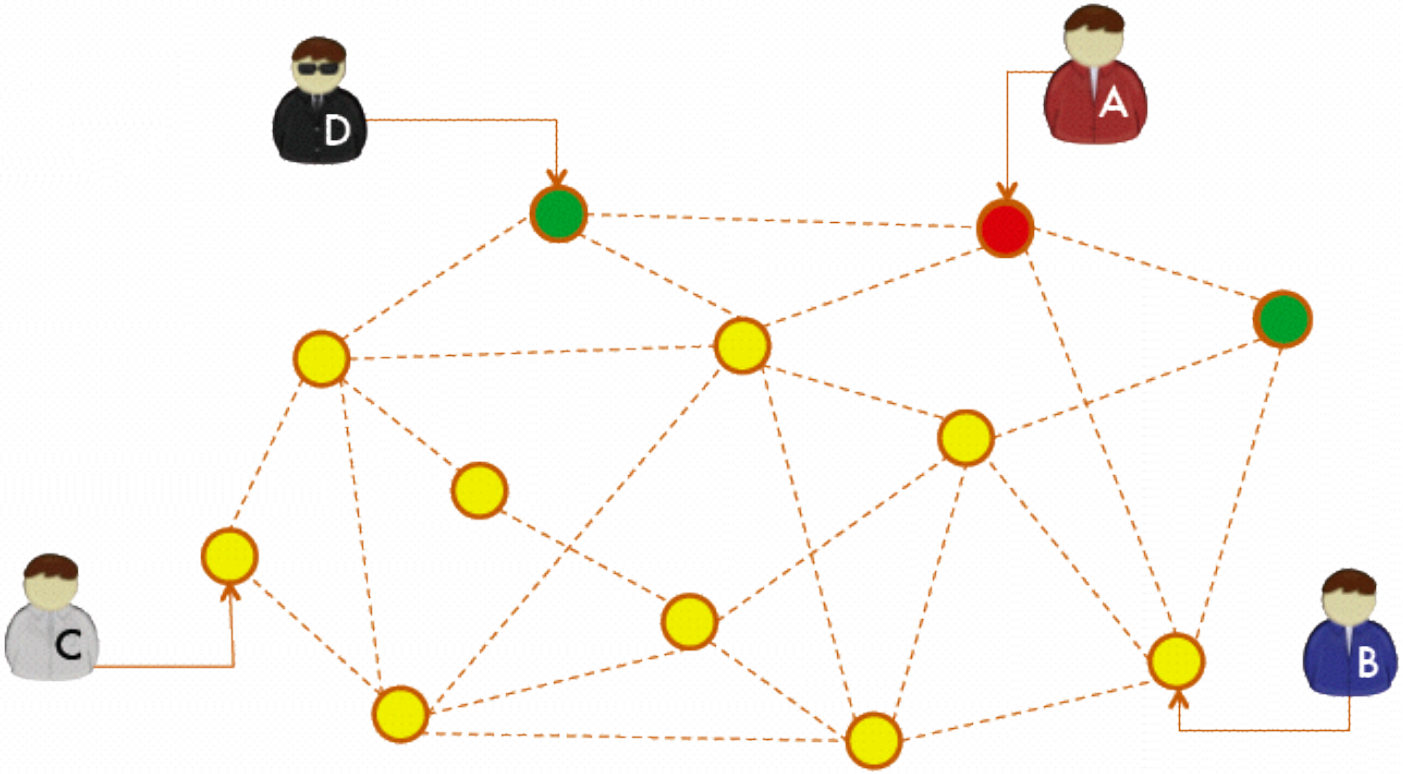

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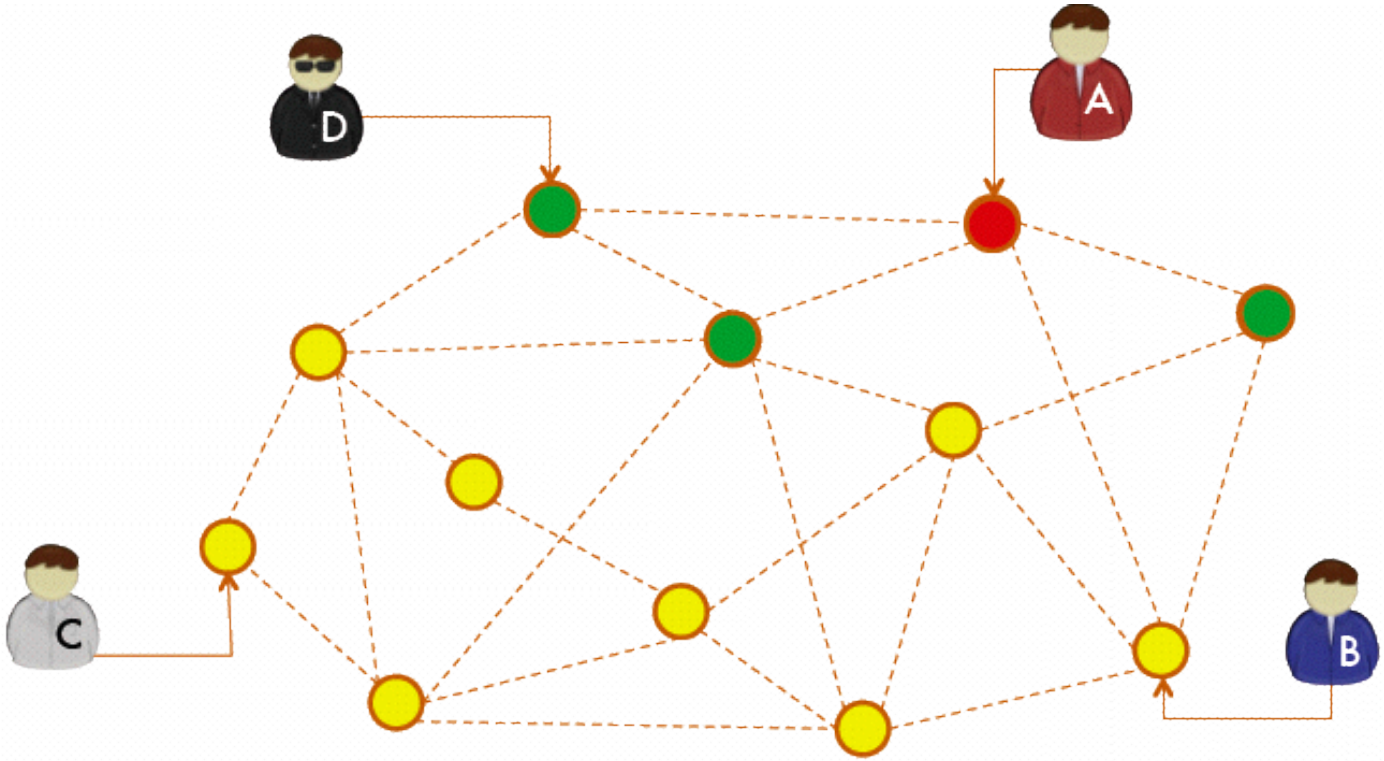

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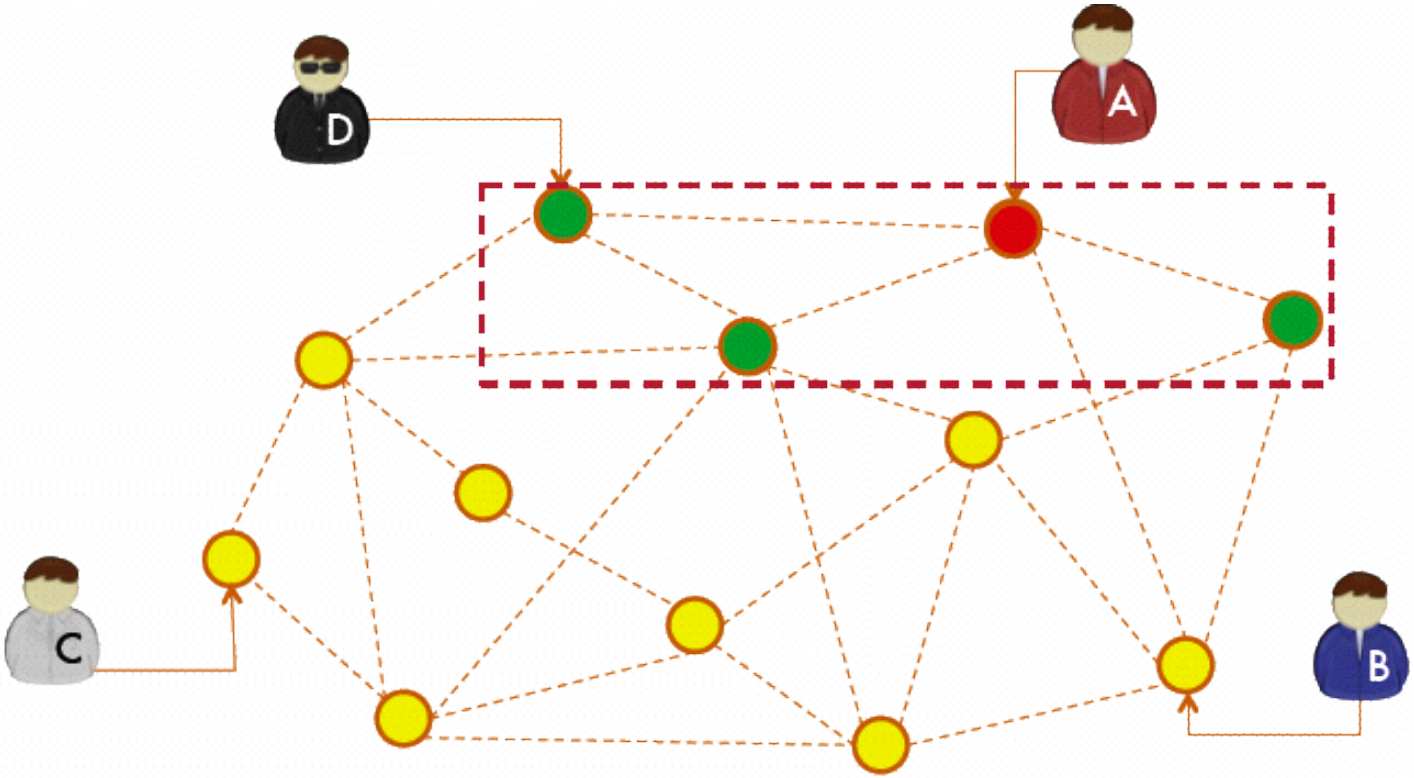

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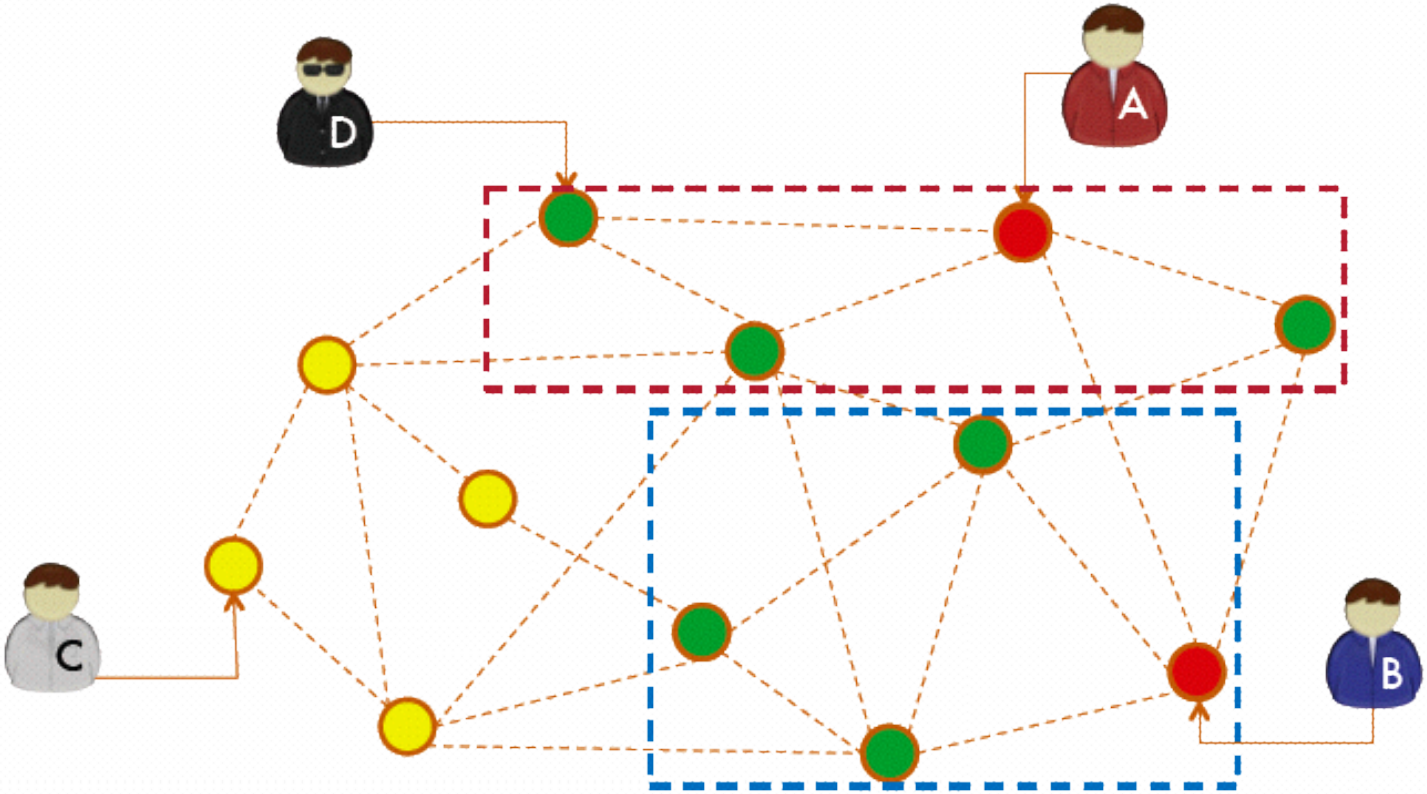

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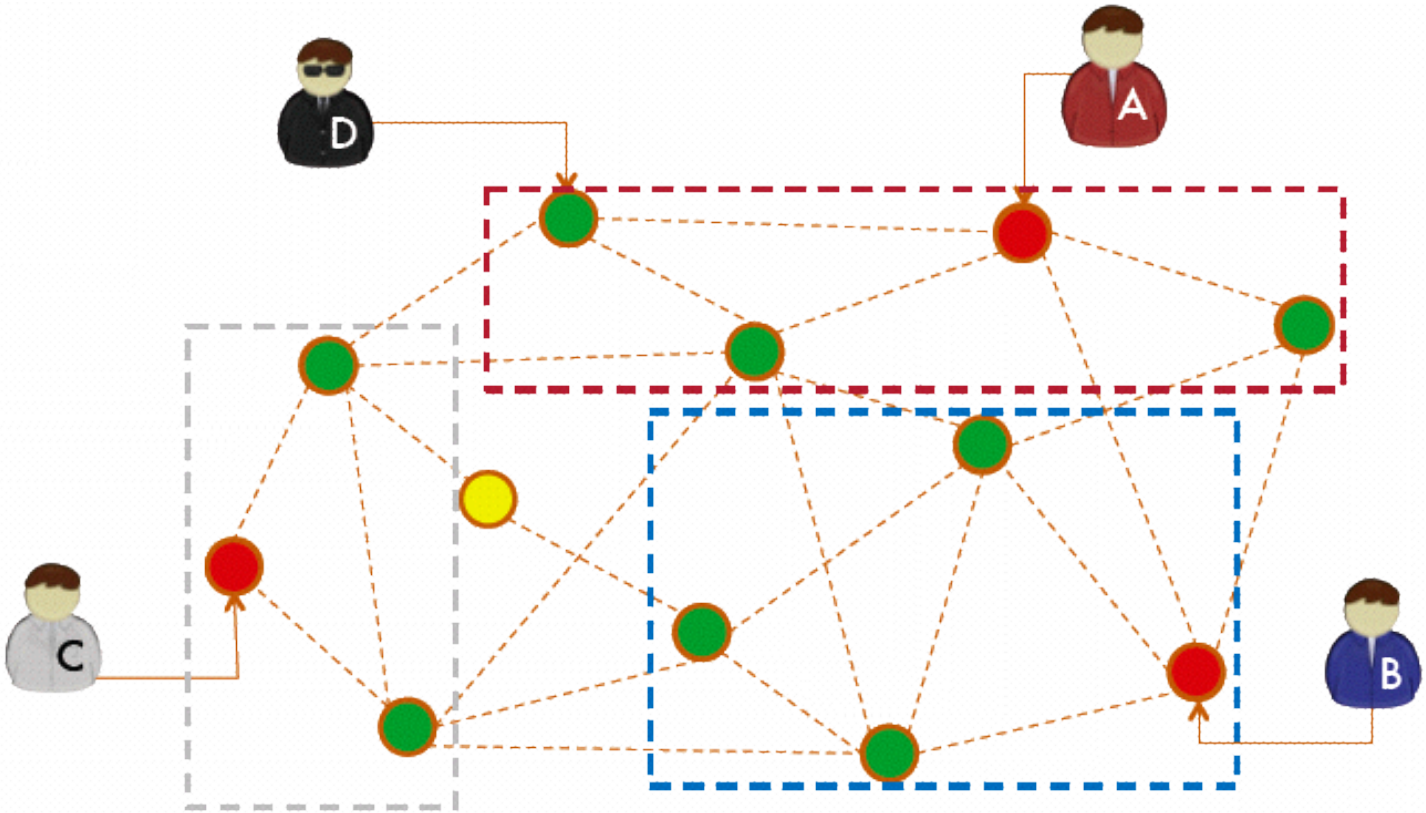

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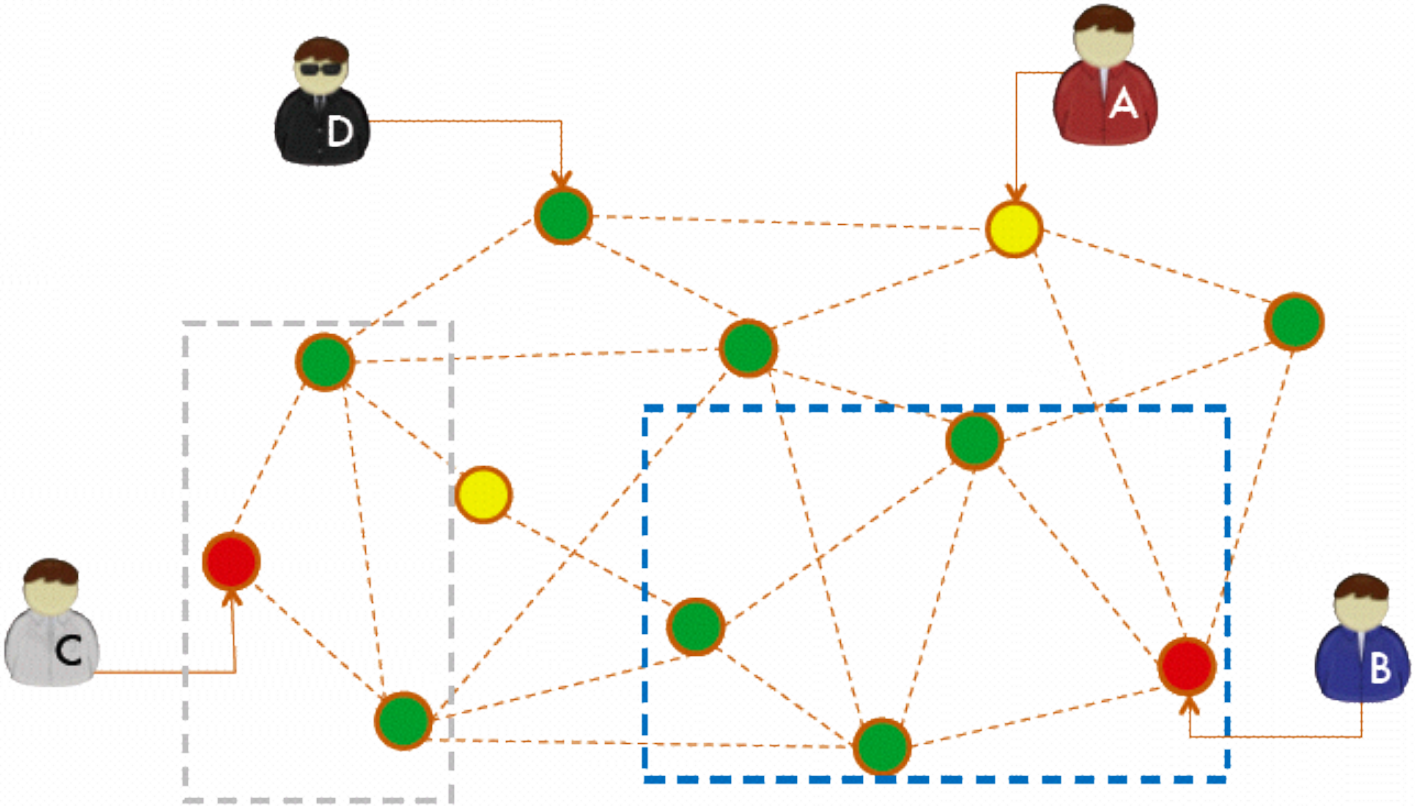

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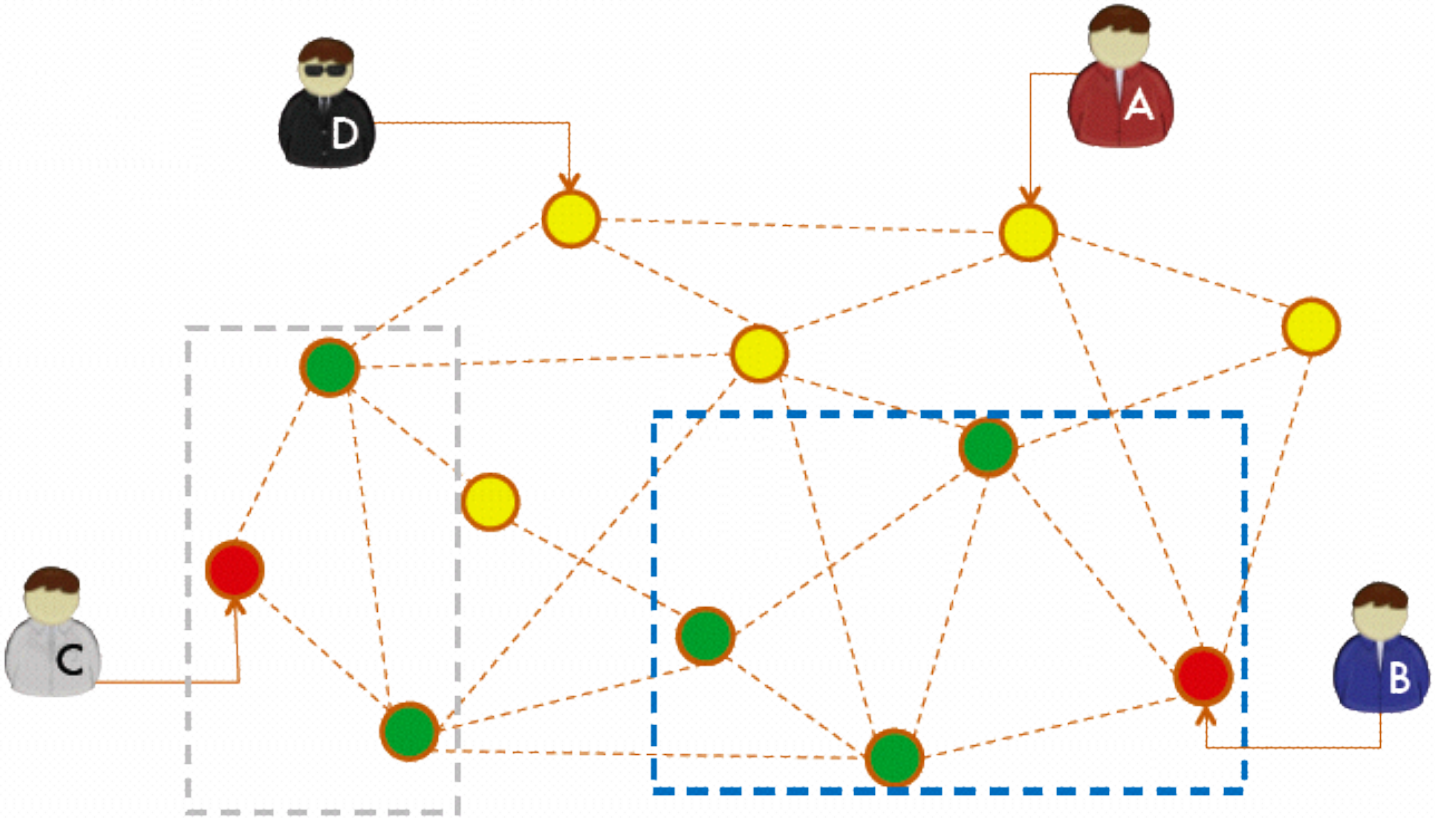

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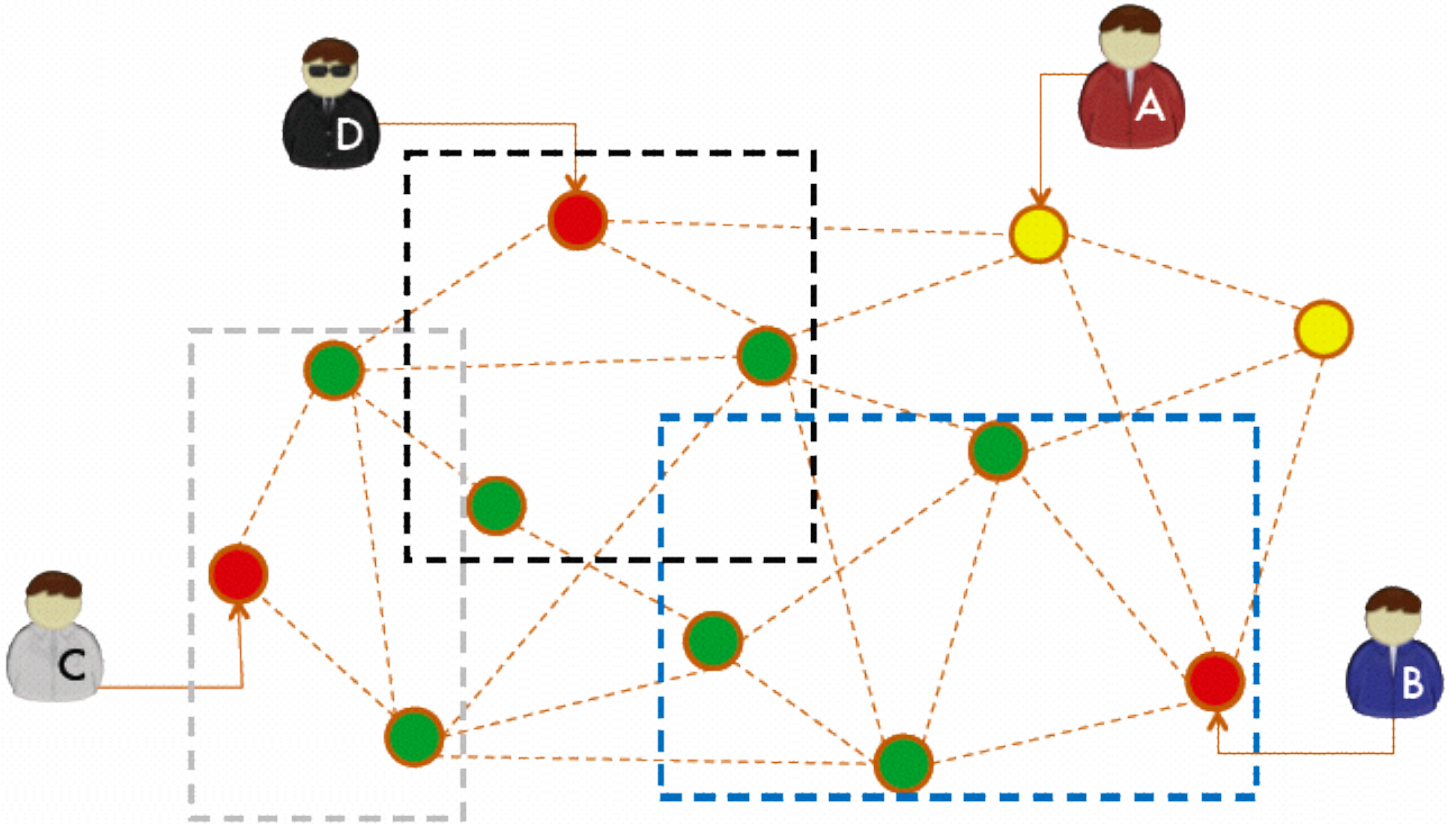

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- The current protocol has been developed/specified with 'ad-hoc' methods → we need to consolidate the trust (ongoing project to verify it, based on Colored Petri Nets)

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- Our solution: tolerate the failure of coordinators
  - For any application we create and manage dynamically copies of the coordinator;
  - We manage k copies; based on passive replication.
  - When a service disappears: we added a special status flag to distinguish between 'end of the application' / 'failure' $\Rightarrow$ slaves can redirect the communication to a copy.

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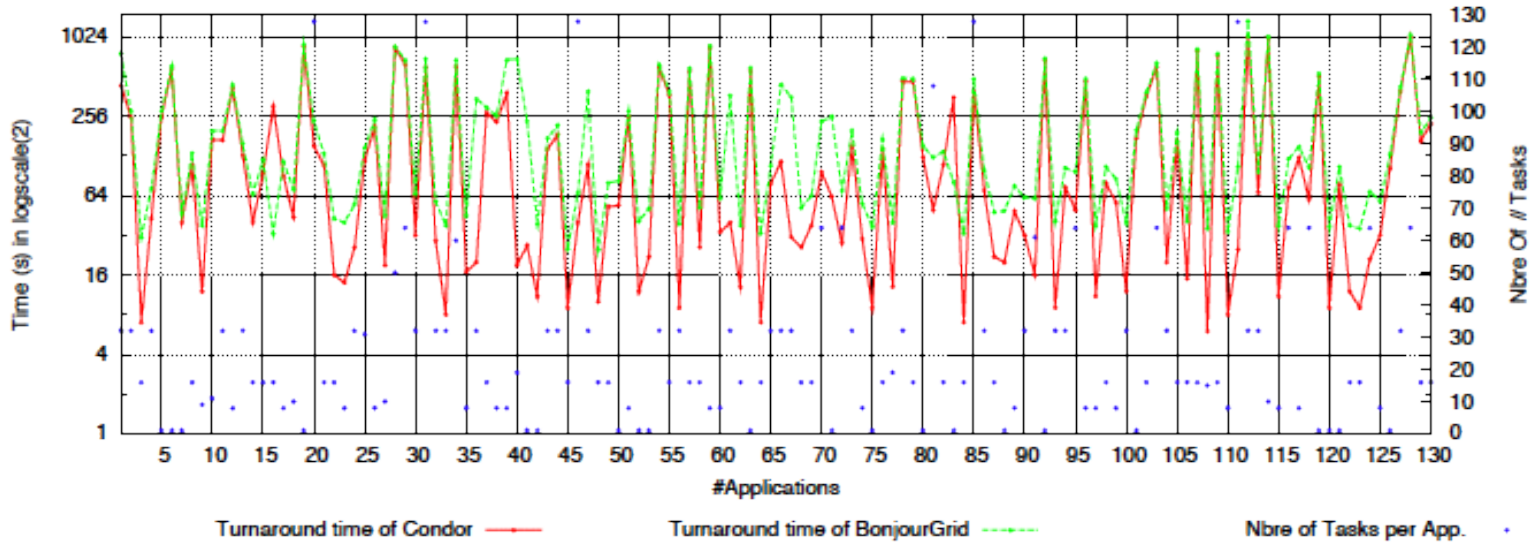
- Example Condor: 130 applications (2 to 128 // tasks), 200 nodes, application task: 1s to 500s. Result: with BonjourGrid, 35% of applications generate a delay of about 30s.

Experiments: one example



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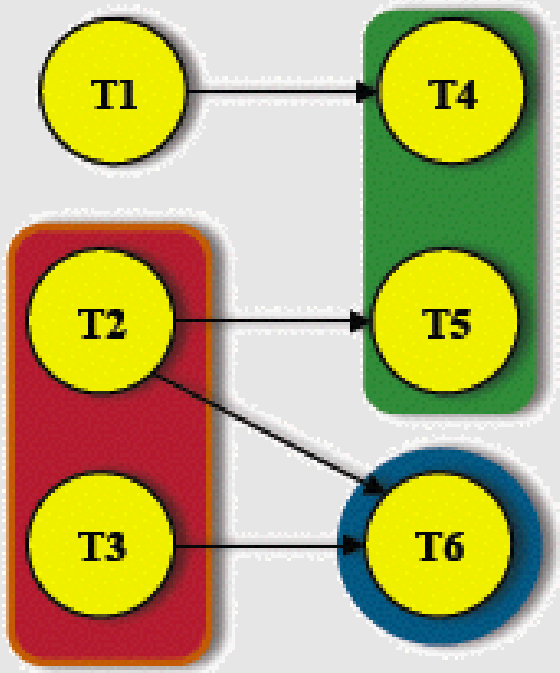

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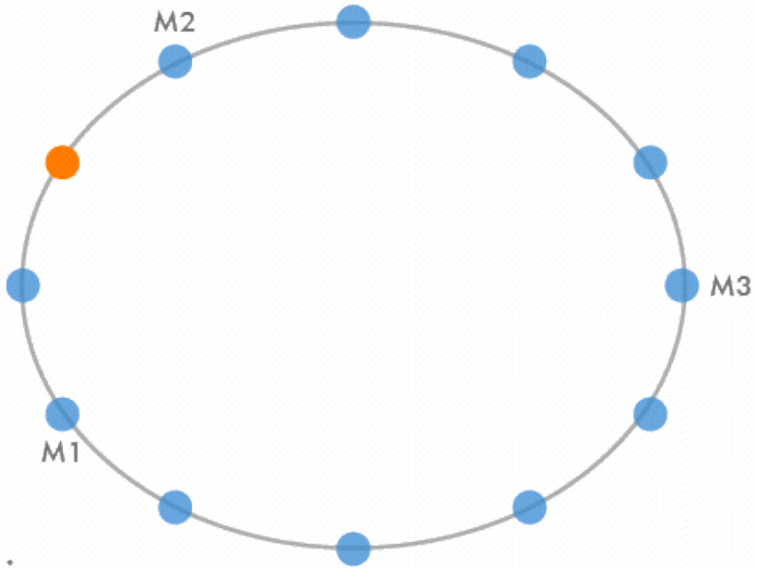

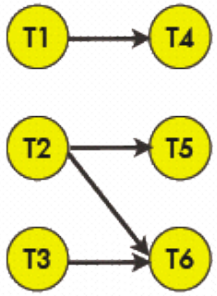

Nœud de soumission

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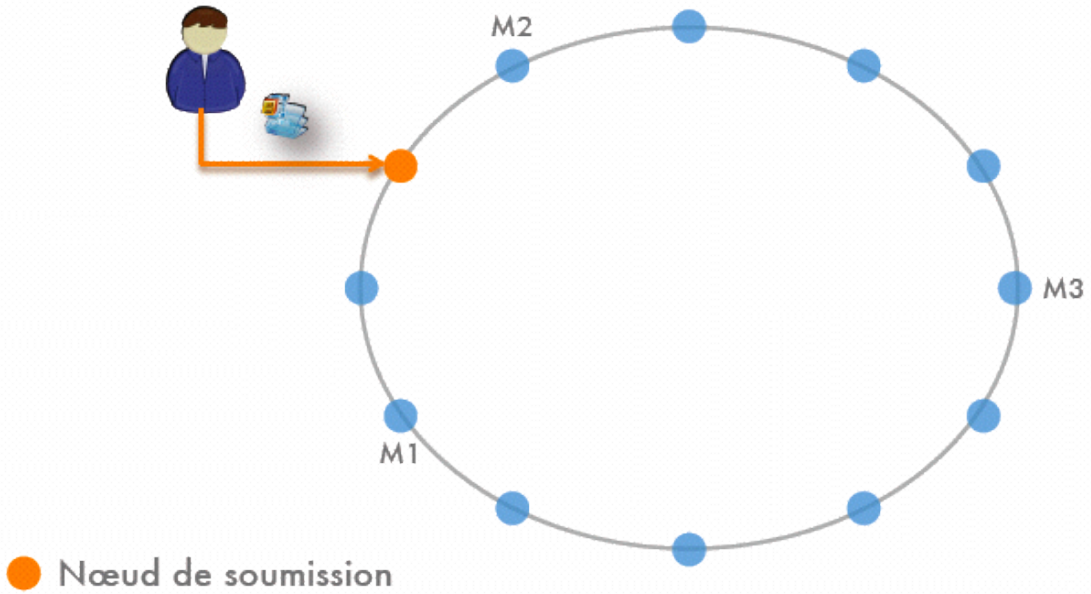

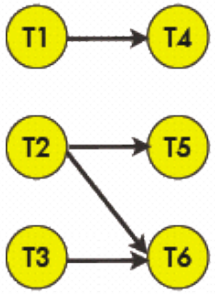

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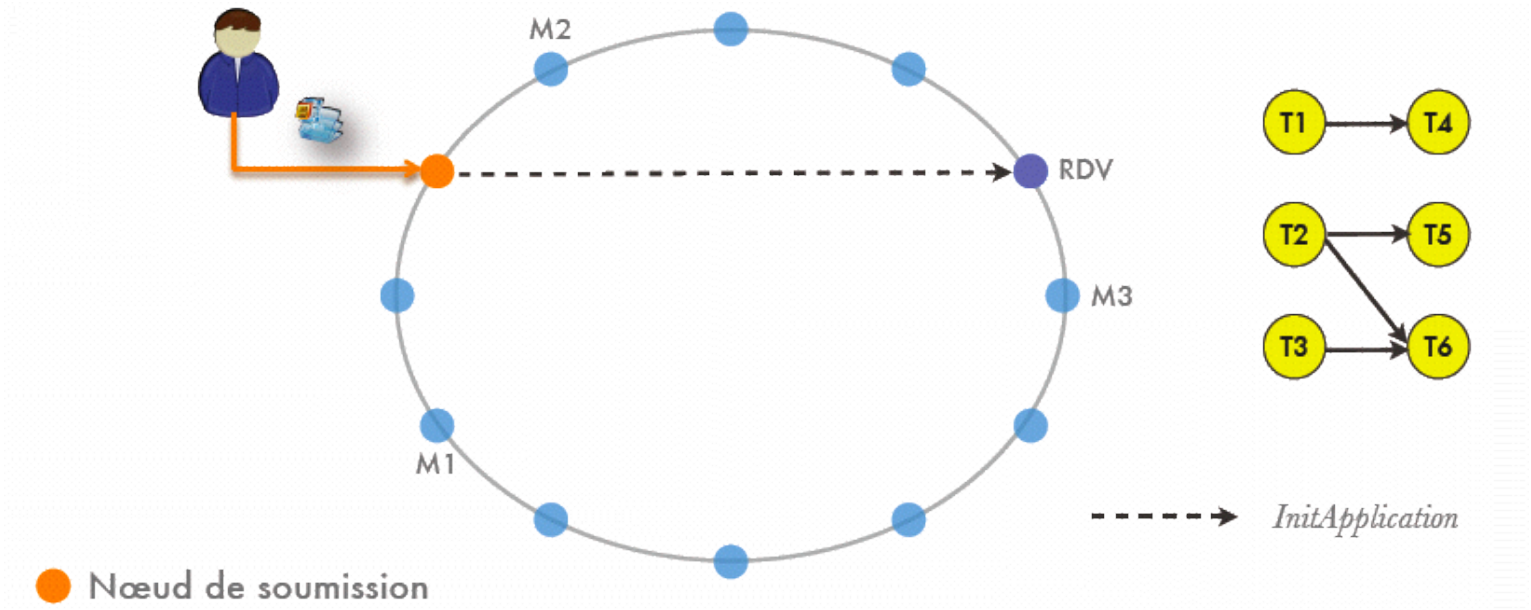

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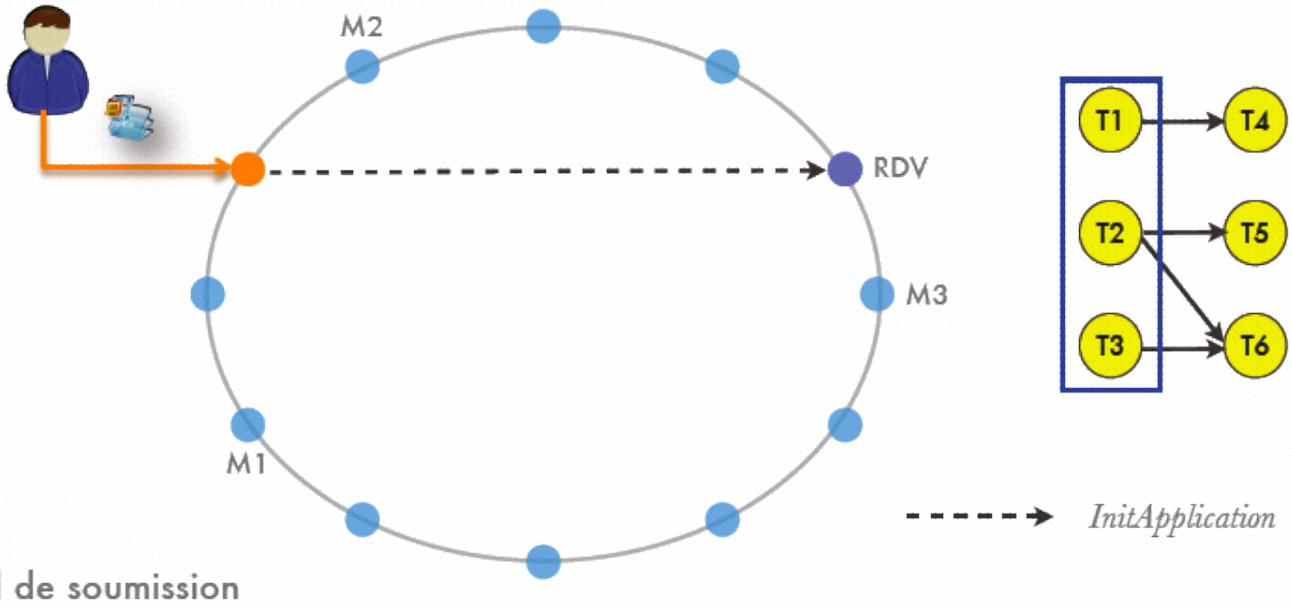

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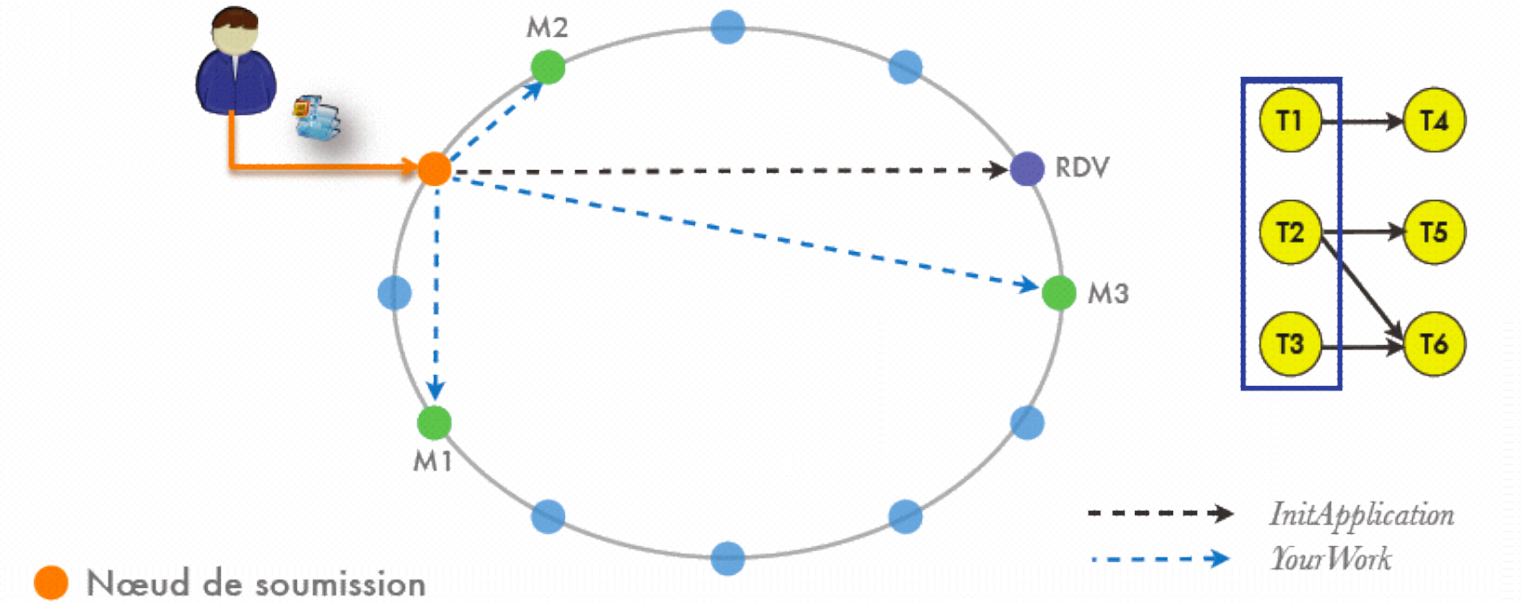

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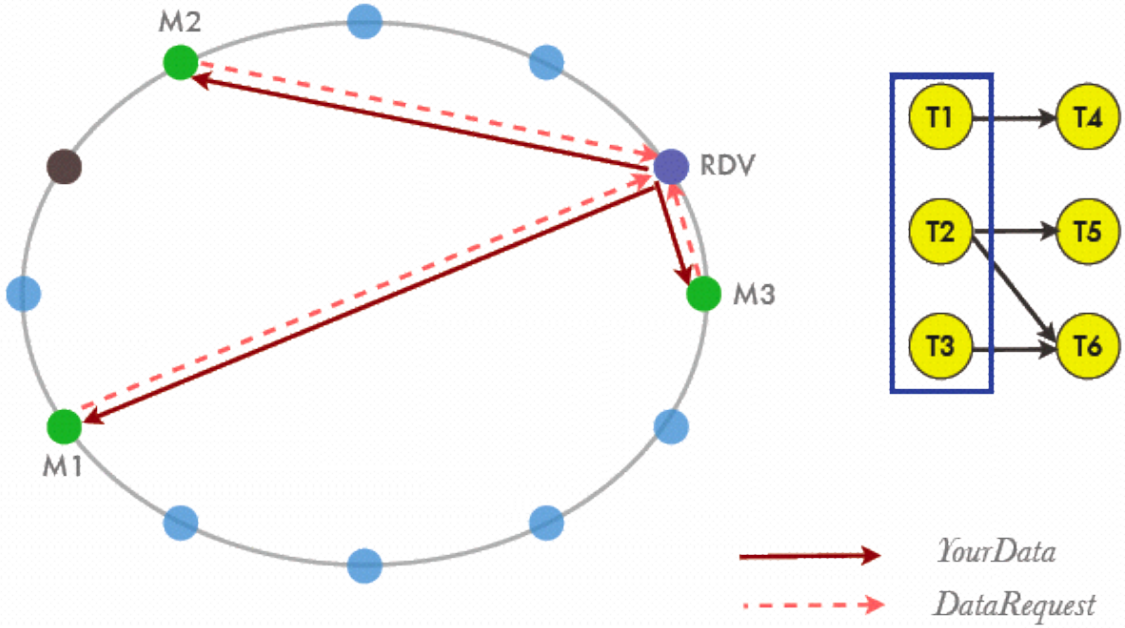

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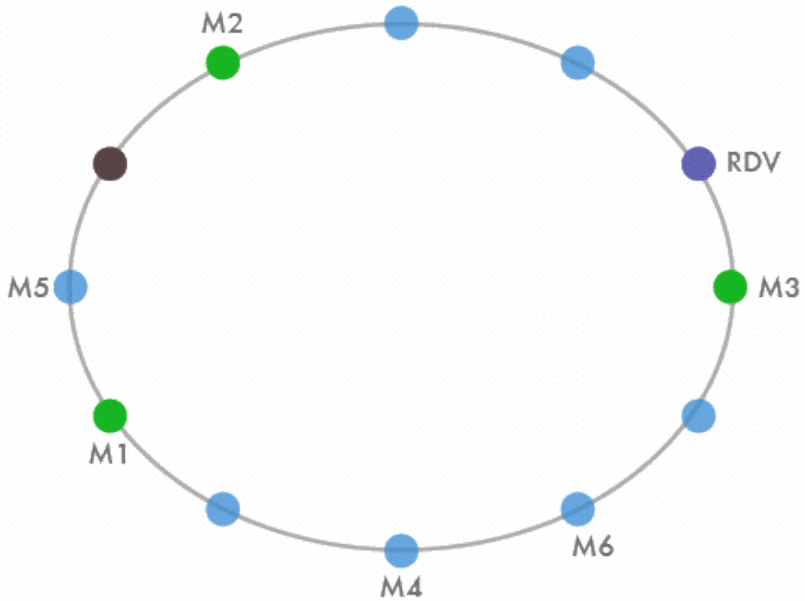

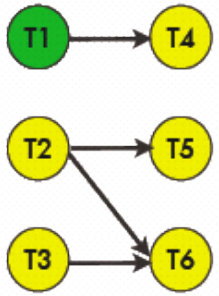

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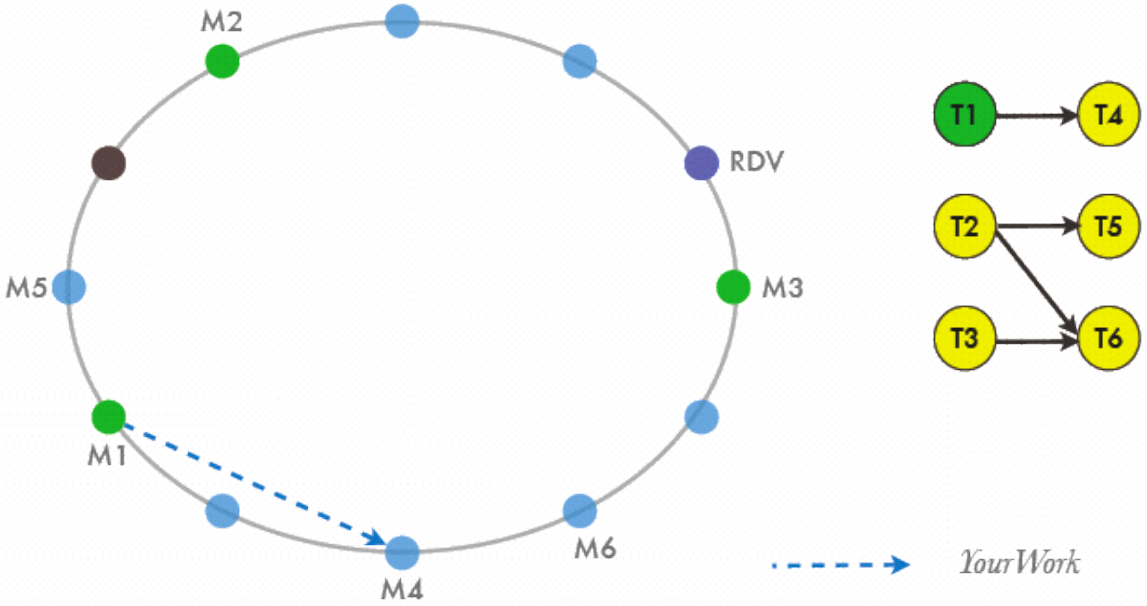

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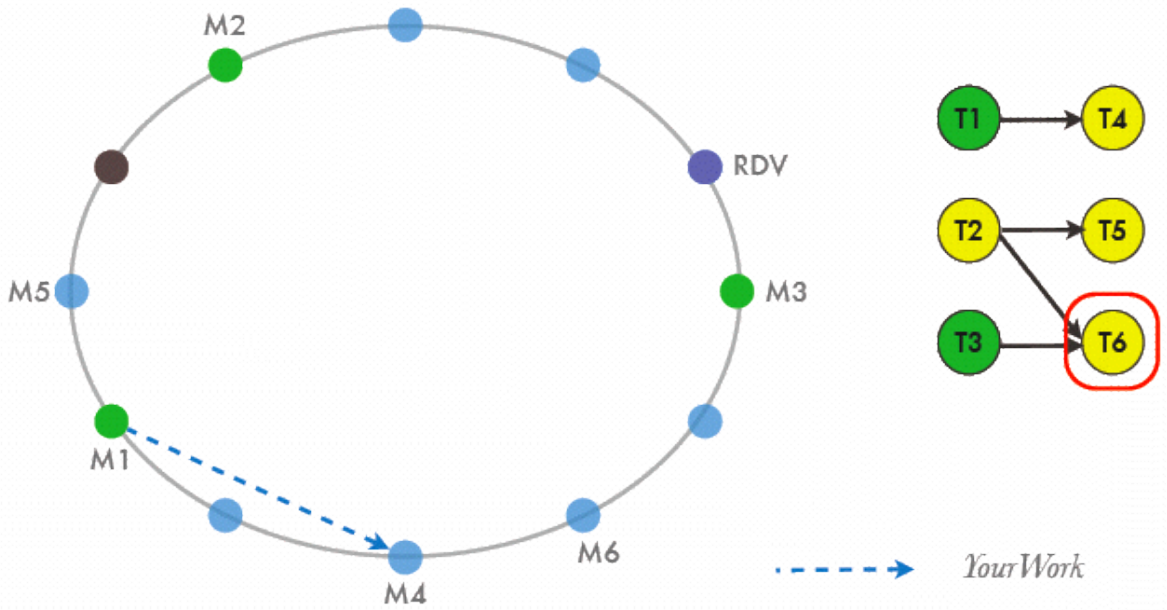

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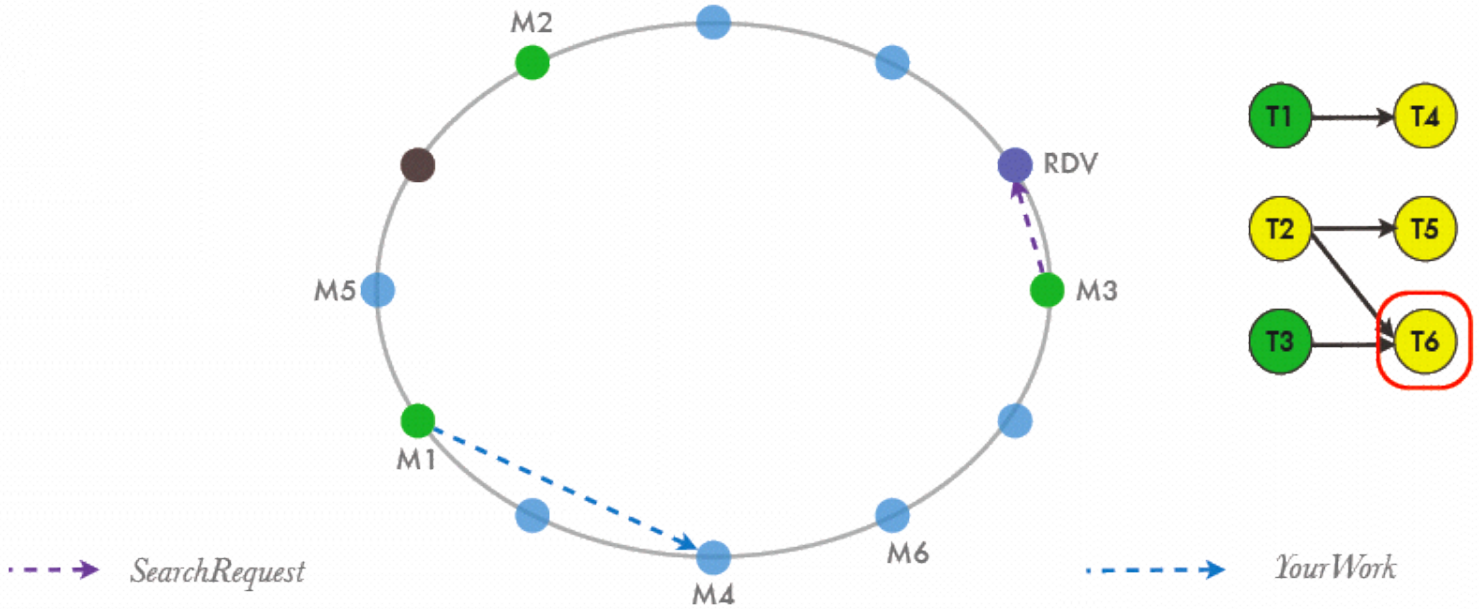

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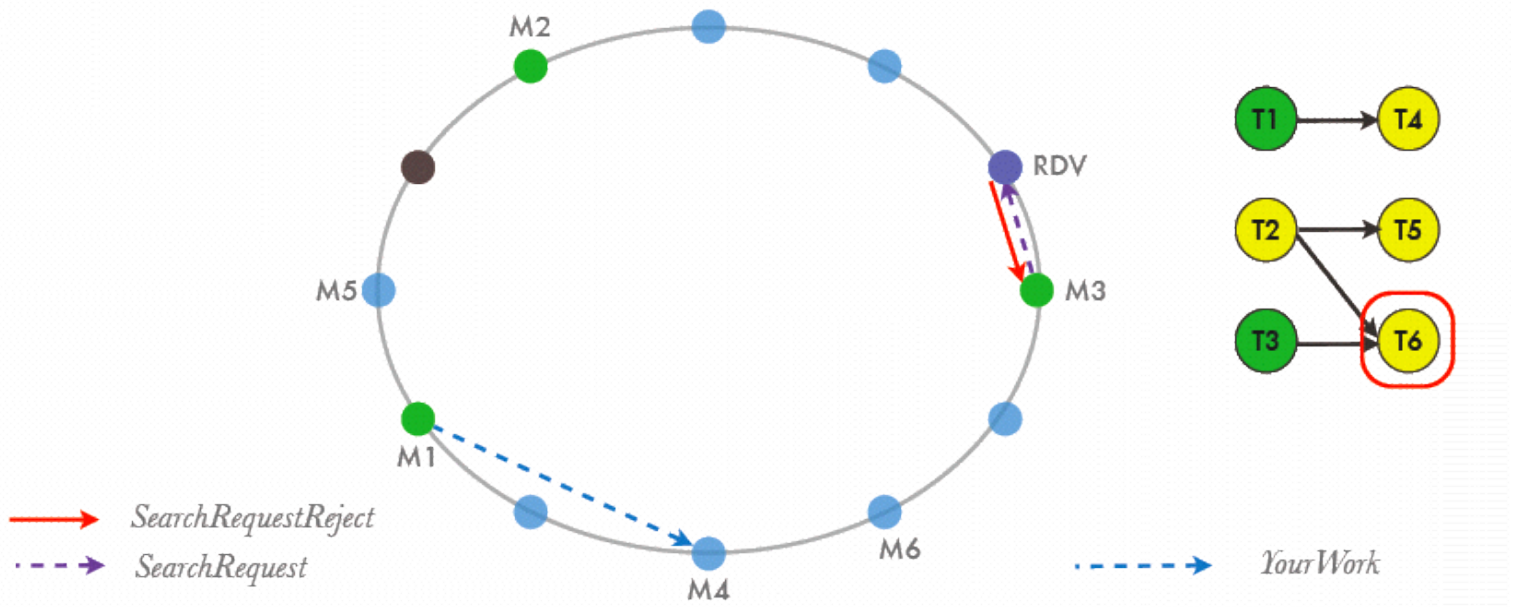

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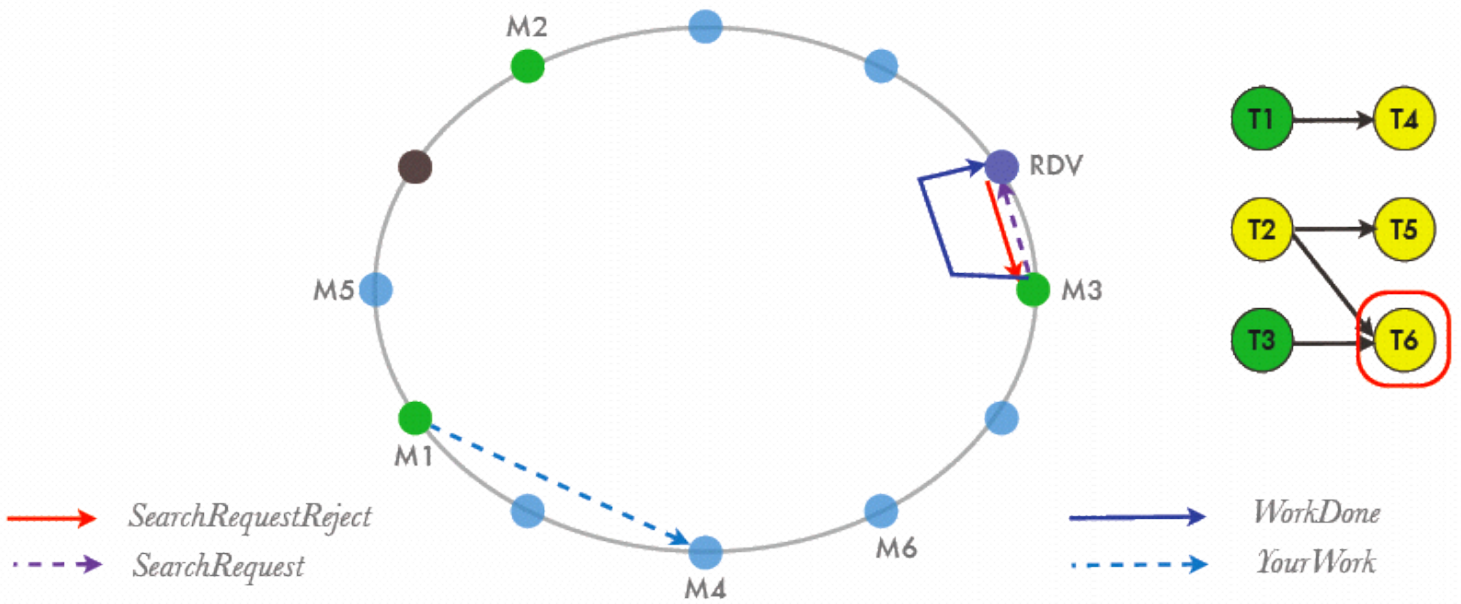

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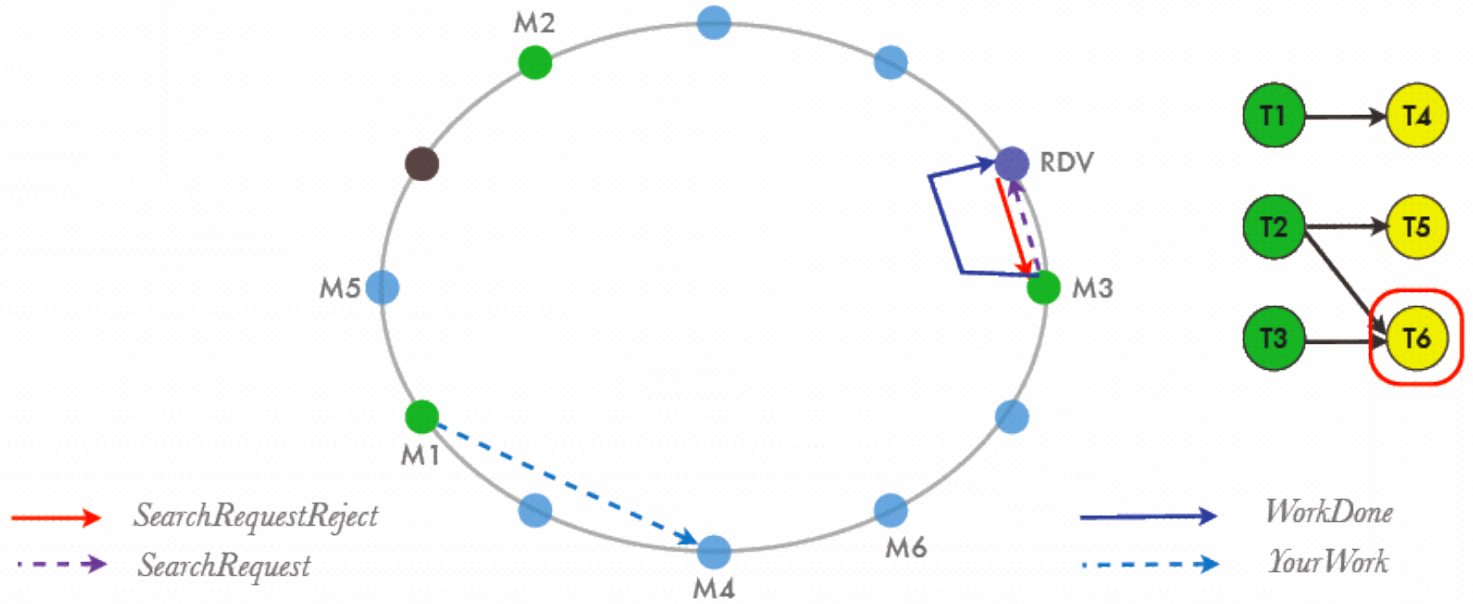

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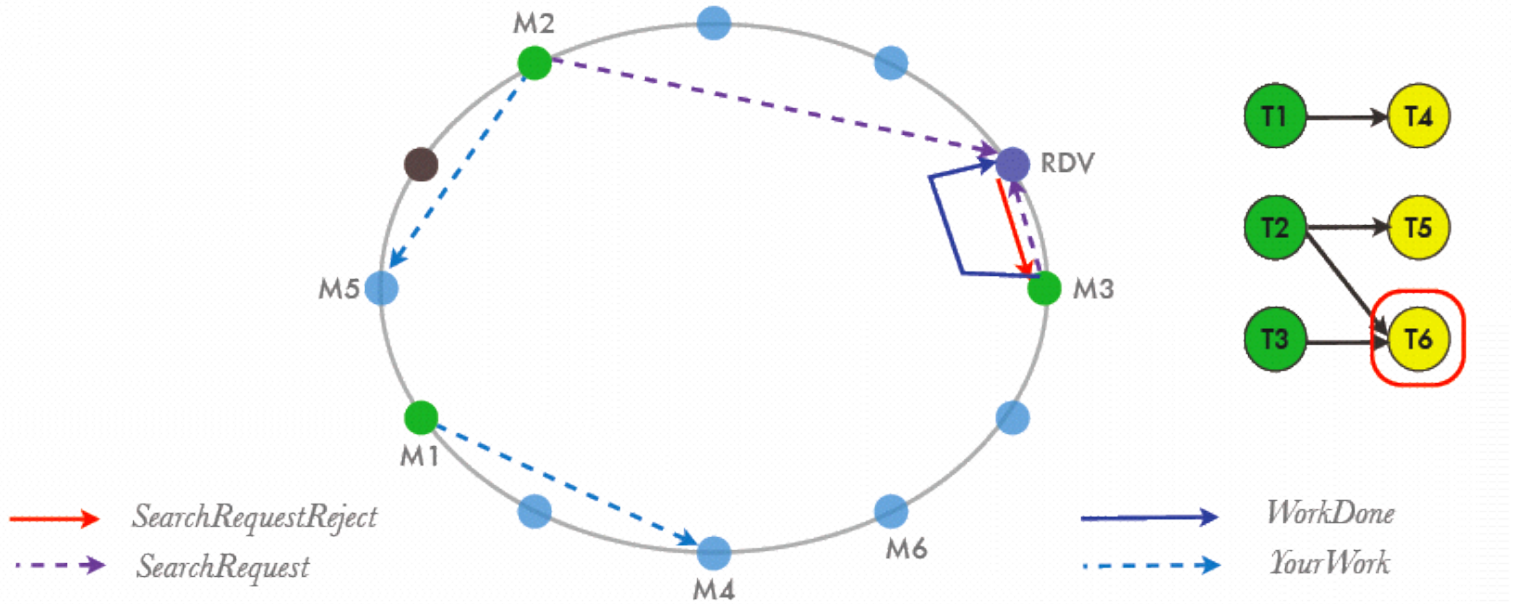

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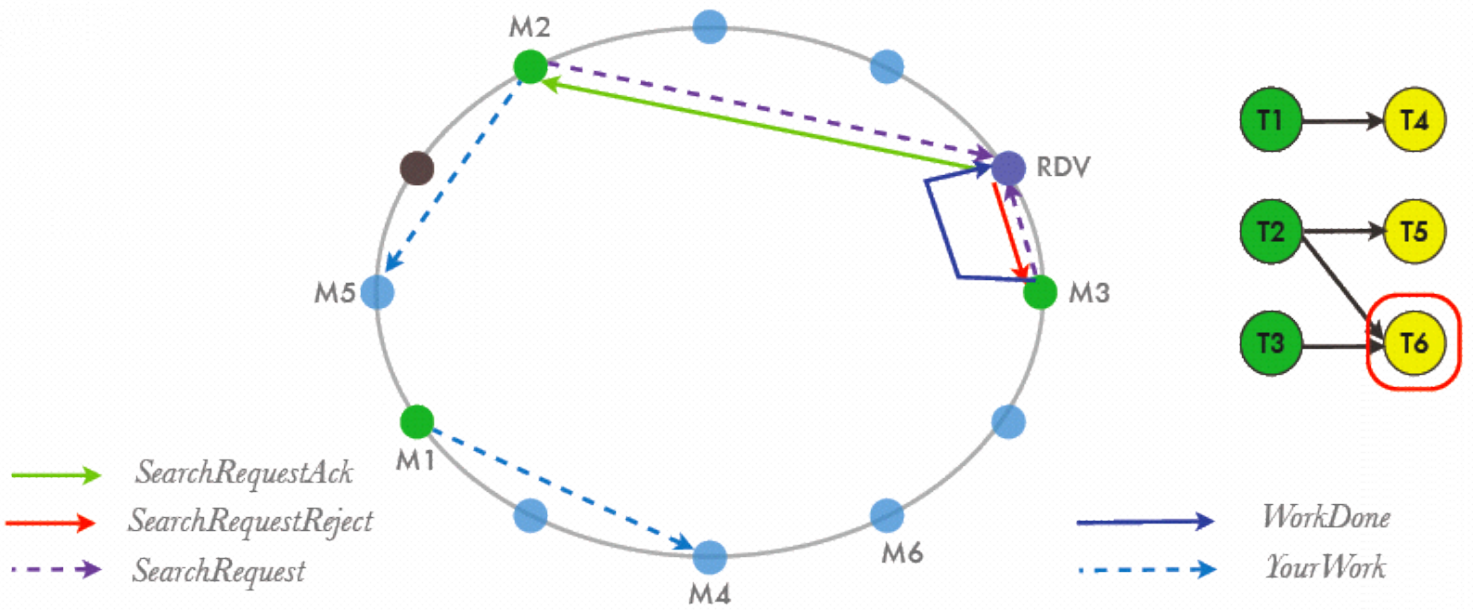

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- Main observations:
  - In all cases, PastryGrid terminates;
  - The recovery time depends on the node type;
  - The delay varies from 4:53s to 7:16:41s. . . but it works! The number of delayed applications varies from 44 to 98.

Towards PaaS and Clouds

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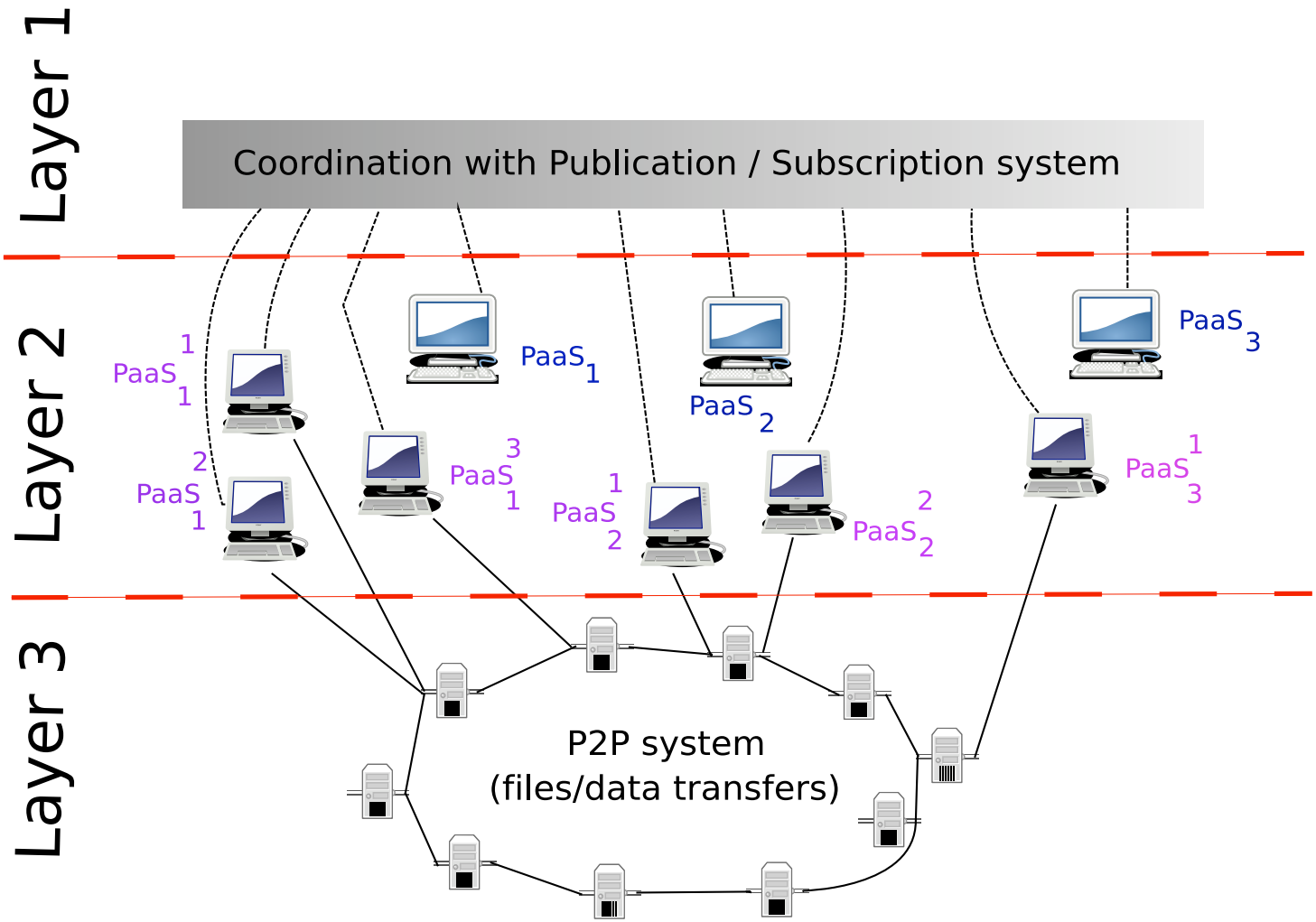
- We have started an initiative for defining and designing a "general purpose PaaS" based on distributed protocols for coordination and data exchange.

Architecture overview of the PaaSoordinated project



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Some Challenges

- Where to insert the different connectors in the PaaS software stack to get an open infrastructure?

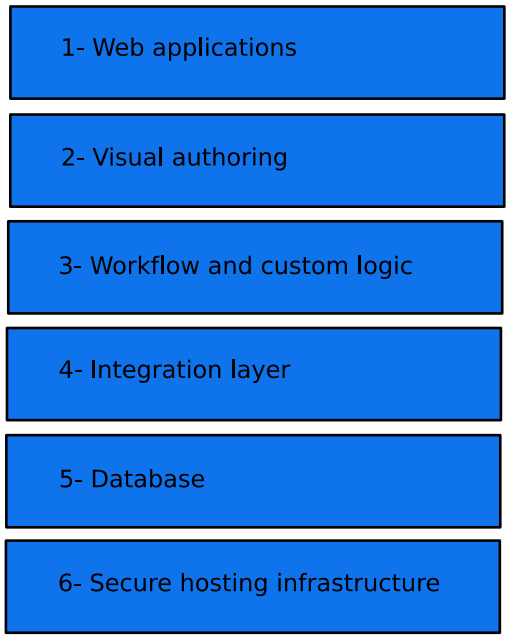

Figure: Software stack in PaaS (source: Coghead)

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- Main change: accept to manage redundancy, scaling the server (even for temporary needs), synchronisation ⇒ coordination with grid technology (BonjourGrid, PastryGrid?);

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- Ex: a company wants to install the Virtual Desktop EyeOS and the TioLive/ERP5 PaaS. During the night, the company rents different services:
  - one (company) to many – many (services) to many (companies) = new abilities, new business!
  - demonstrate that a single coordination protocol is better than configuring as many middlewares than we have software!

Towards PaaS and Clouds Our experience with BonjourGrid and PastryGrid – AOC Team –

Christophe Cérin[1]

[1]Université de Paris XIII, CNRS UMR 7030, France

Bi-lateral China-France workshop