Planning live-migrations to prepare servers for maintenance

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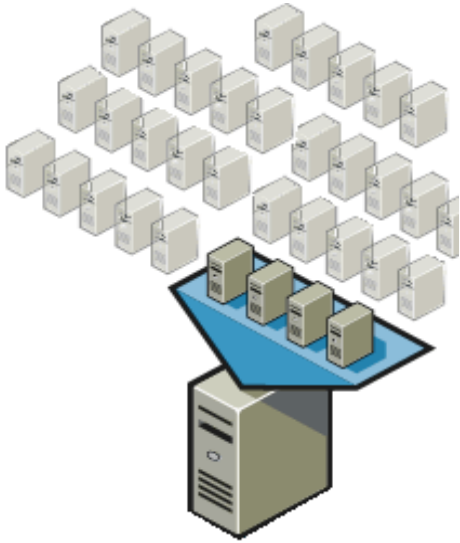
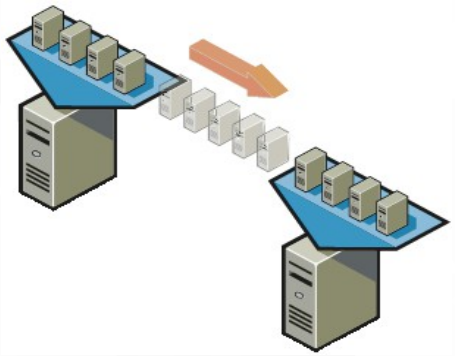
Servers maintenance tasks in virtualized DCs

- Hosting capabilities
  - Performance isolation
  - Consolidation techniques

    Increasing number of VMs per server



- Server maintenance
  - Need to operate on idle or offline servers
  - **Live-Migrations** to prepare for the operation
  - Impact all running VMs
  - Server preparation is a critical task !

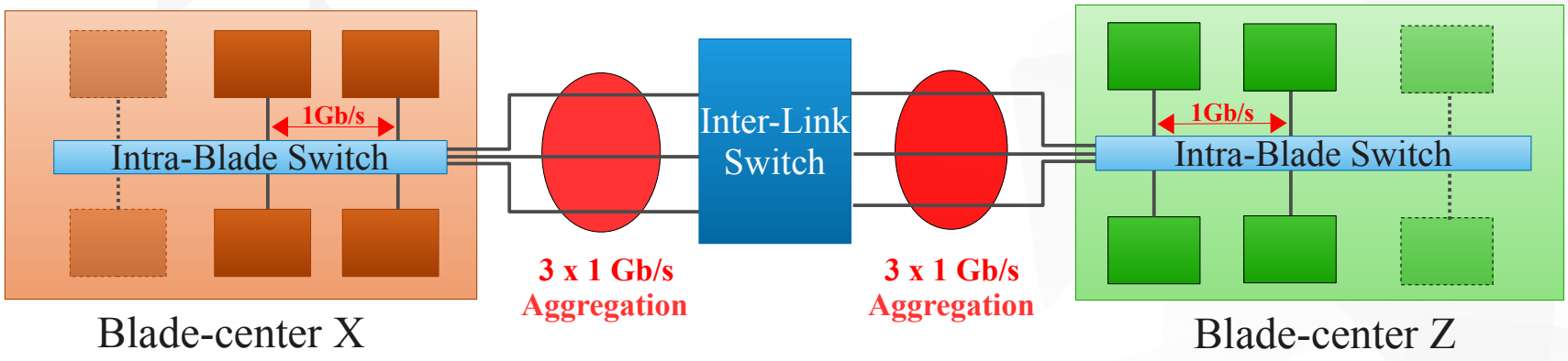


Problematic: How to prepare servers maintenance efficiently

- A problem with many facets
  - Completion times
  - Migration duration
  - Energy usage
  - Technical, environmental, human aspects
- Our contribution: analysis of realistic migrations plans
  - Exhibit common pitfall
  - Deduce levers to improve their quality/efficiency
  - Propose improvements

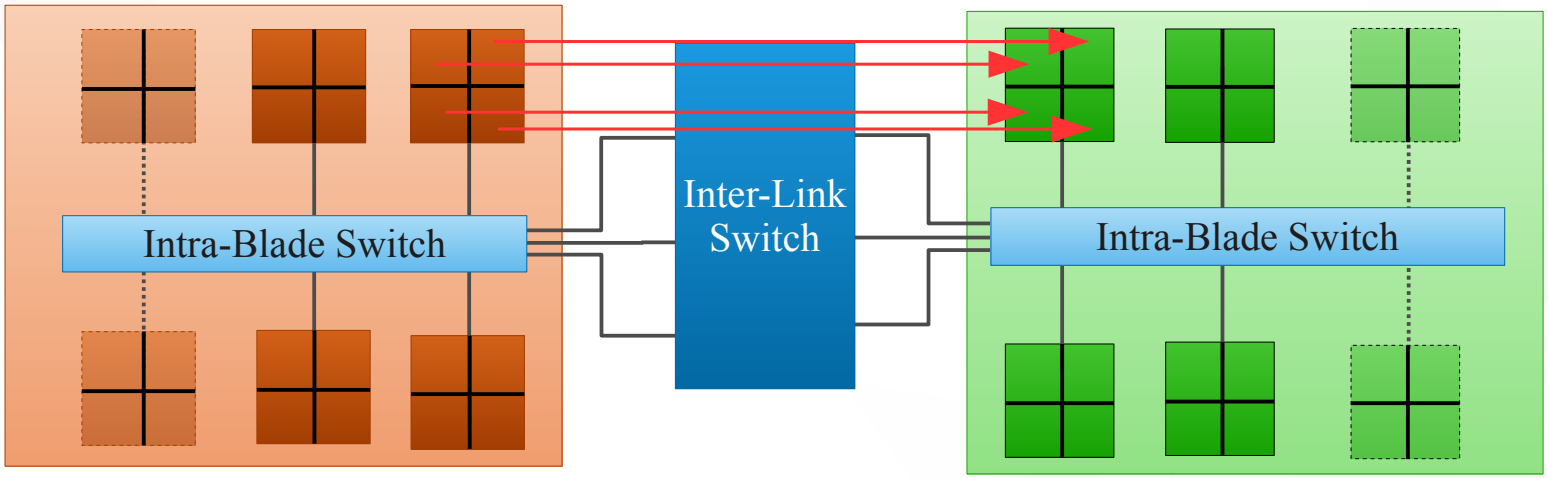
Experimenting servers preparation

- Experimental testbed
  - 3 blade-centers: Bullx B500
  - 15 servers per blade-center: - 2 CPU quad-core @ 2.27GHz,
    - 24 GB ram
- Network
  - 3 x 1 GB/s Inter-link between blade-centers



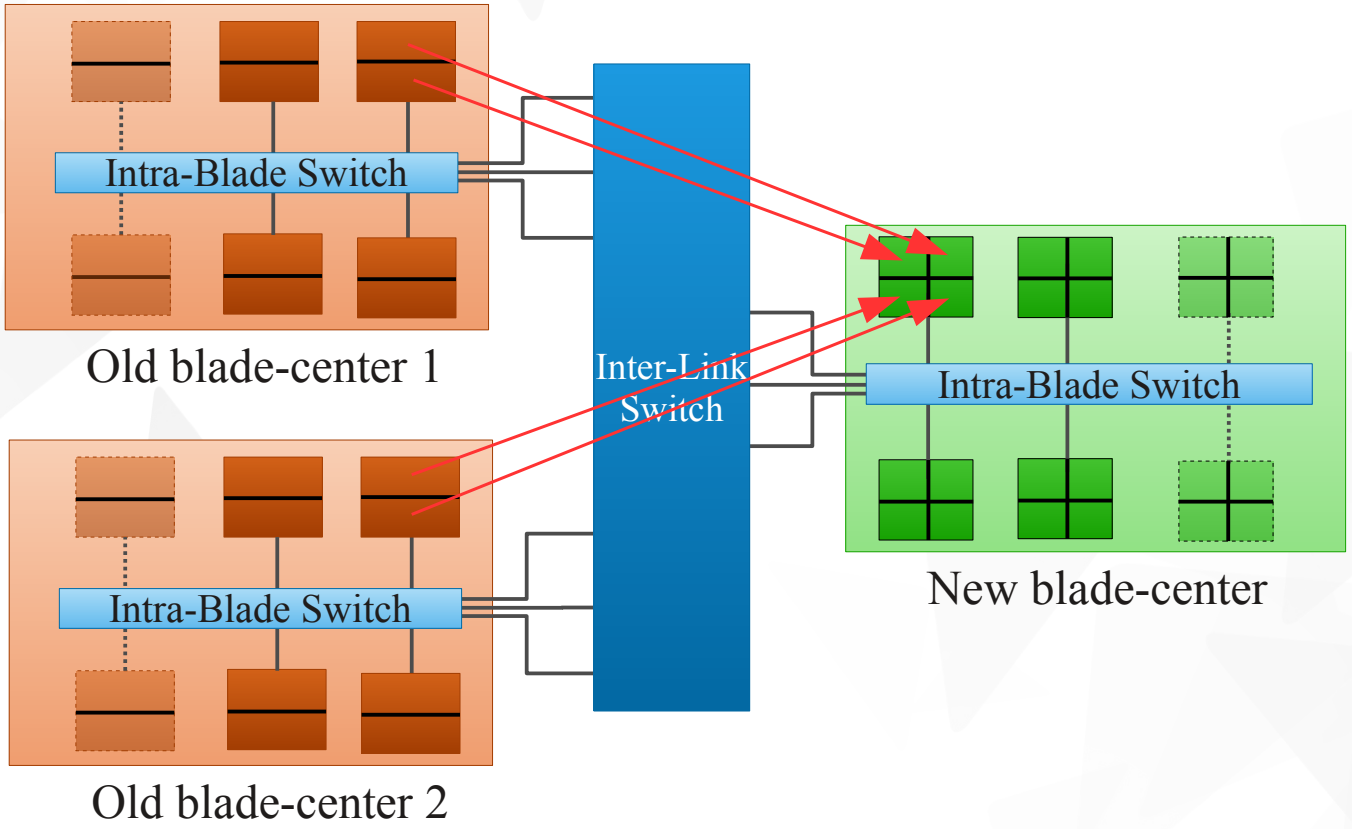
Experimenting servers preparation

- Scenario: Blade-center maintenance
  - 4 VMs per server
  - 60 VMs to relocate to spare servers



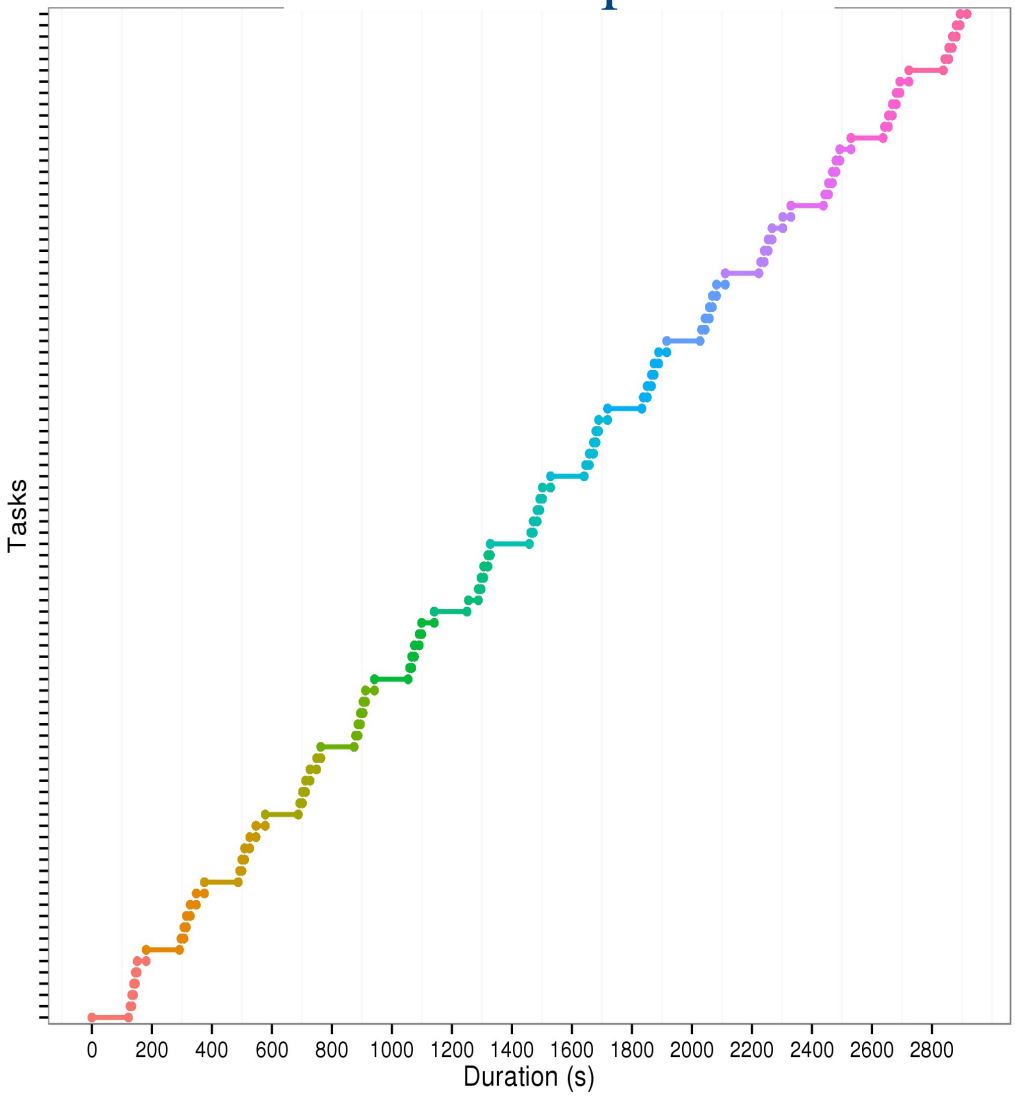
Experimenting servers preparation

- Scenario: Server upgrading
  - Blade-centers replacement
  - From 2 to 4 VMs per server

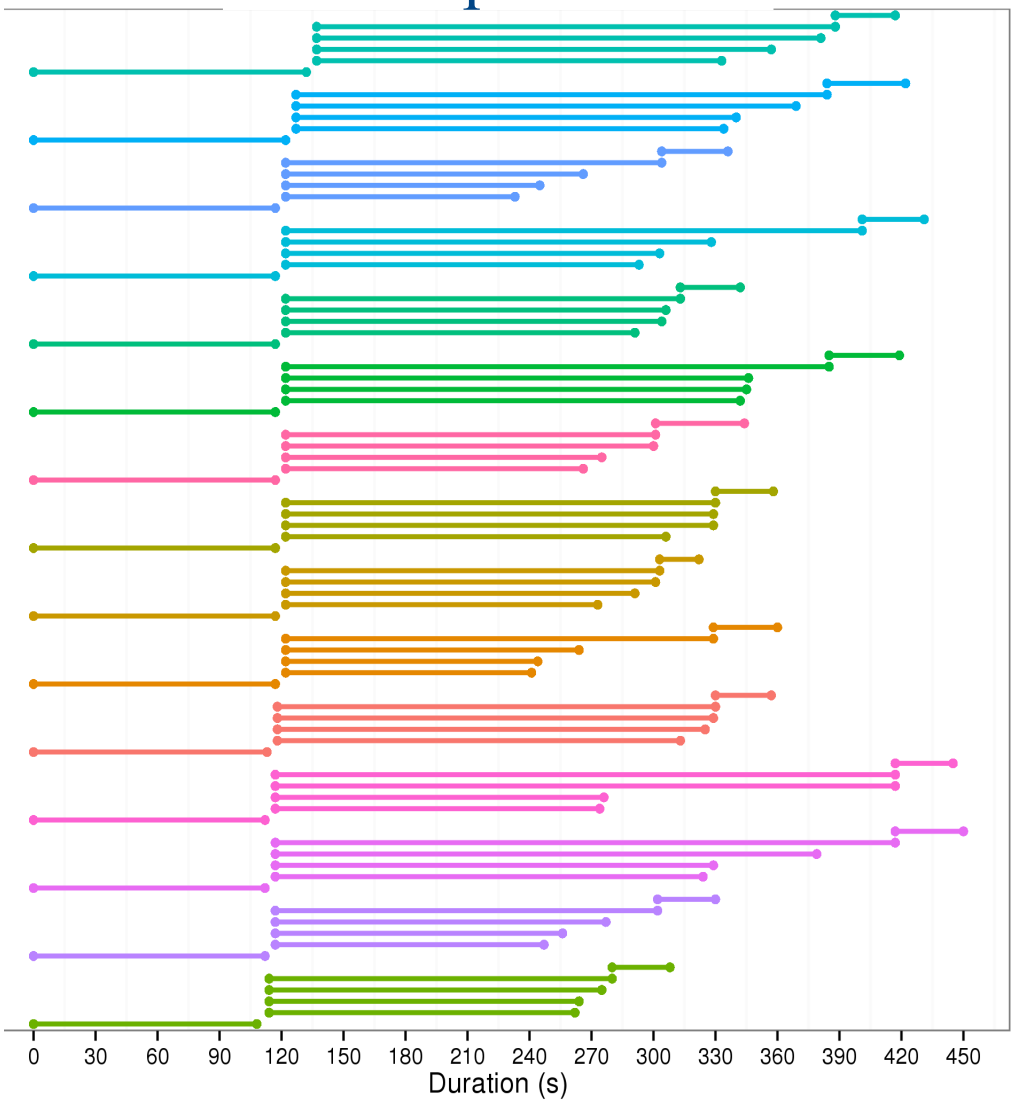


Blade-center maintenance

Full sequential



Full parallel



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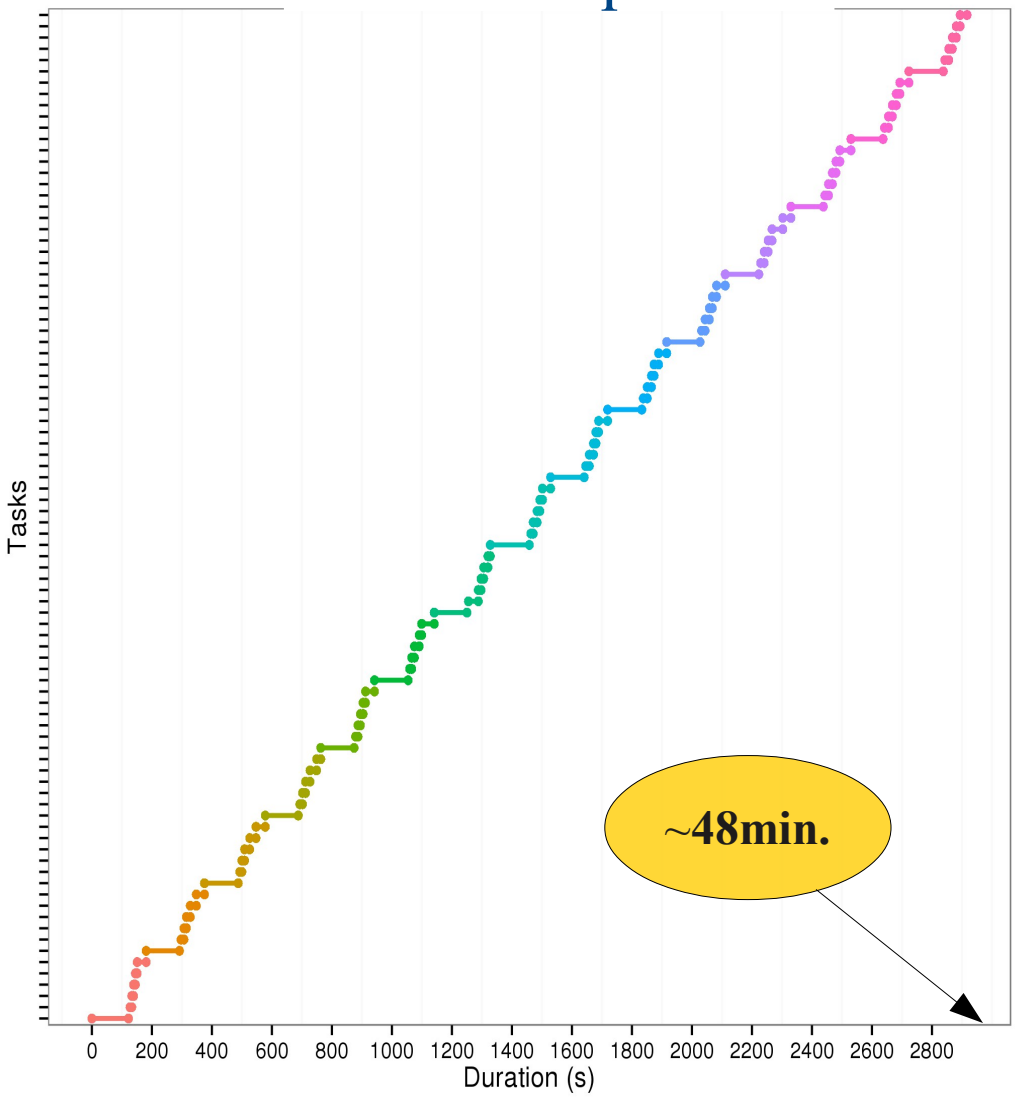

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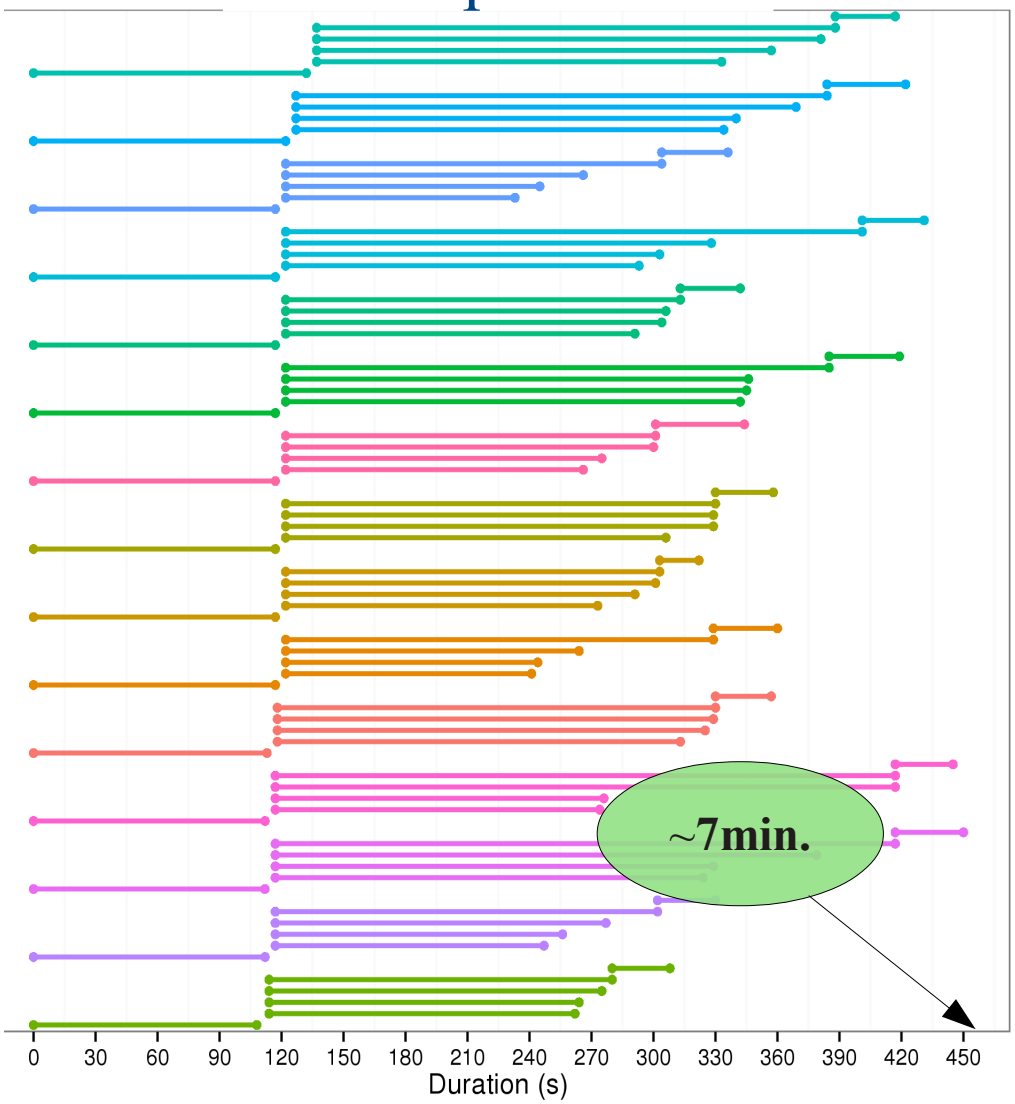
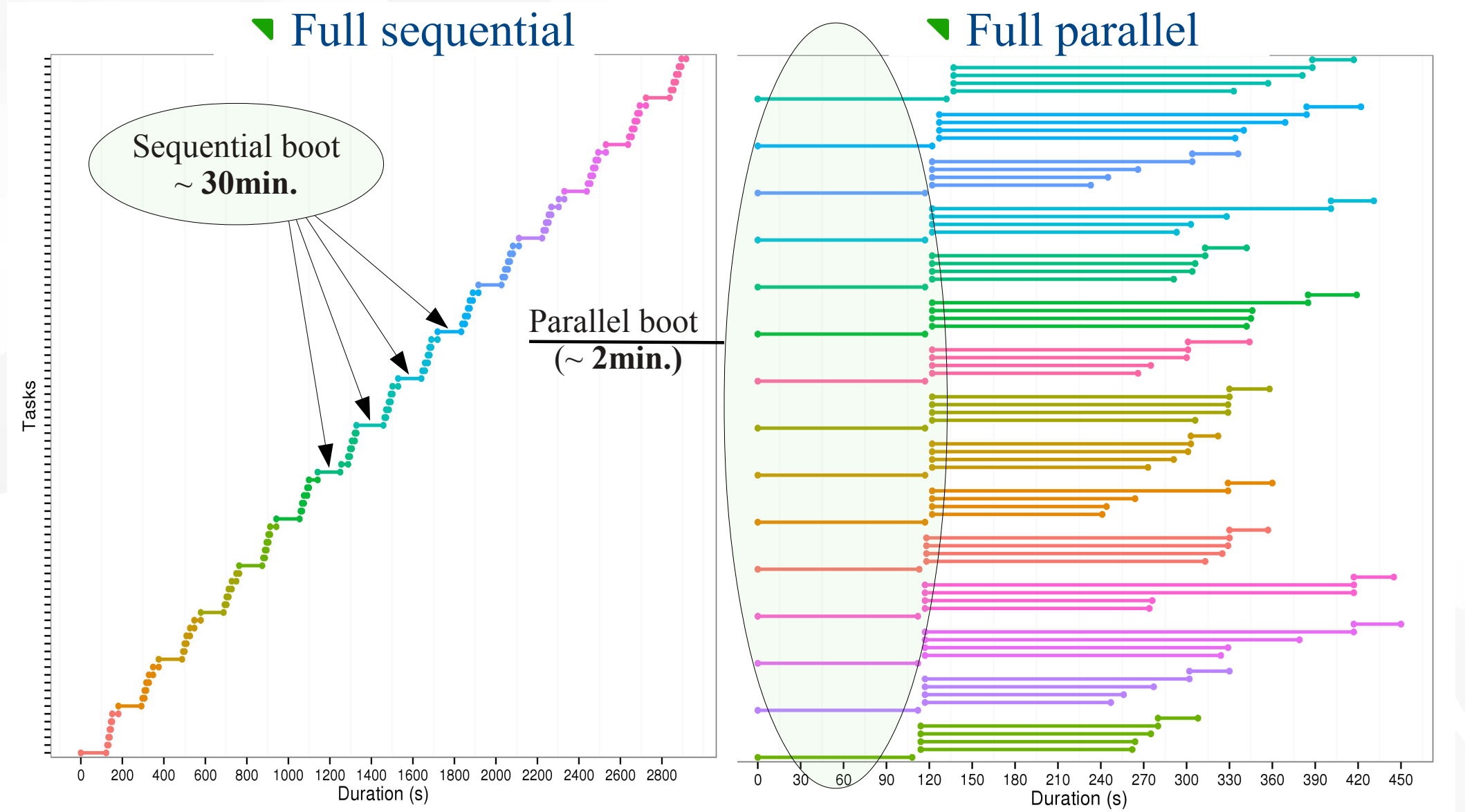


Blade-center maintenance



Blade-center maintenance

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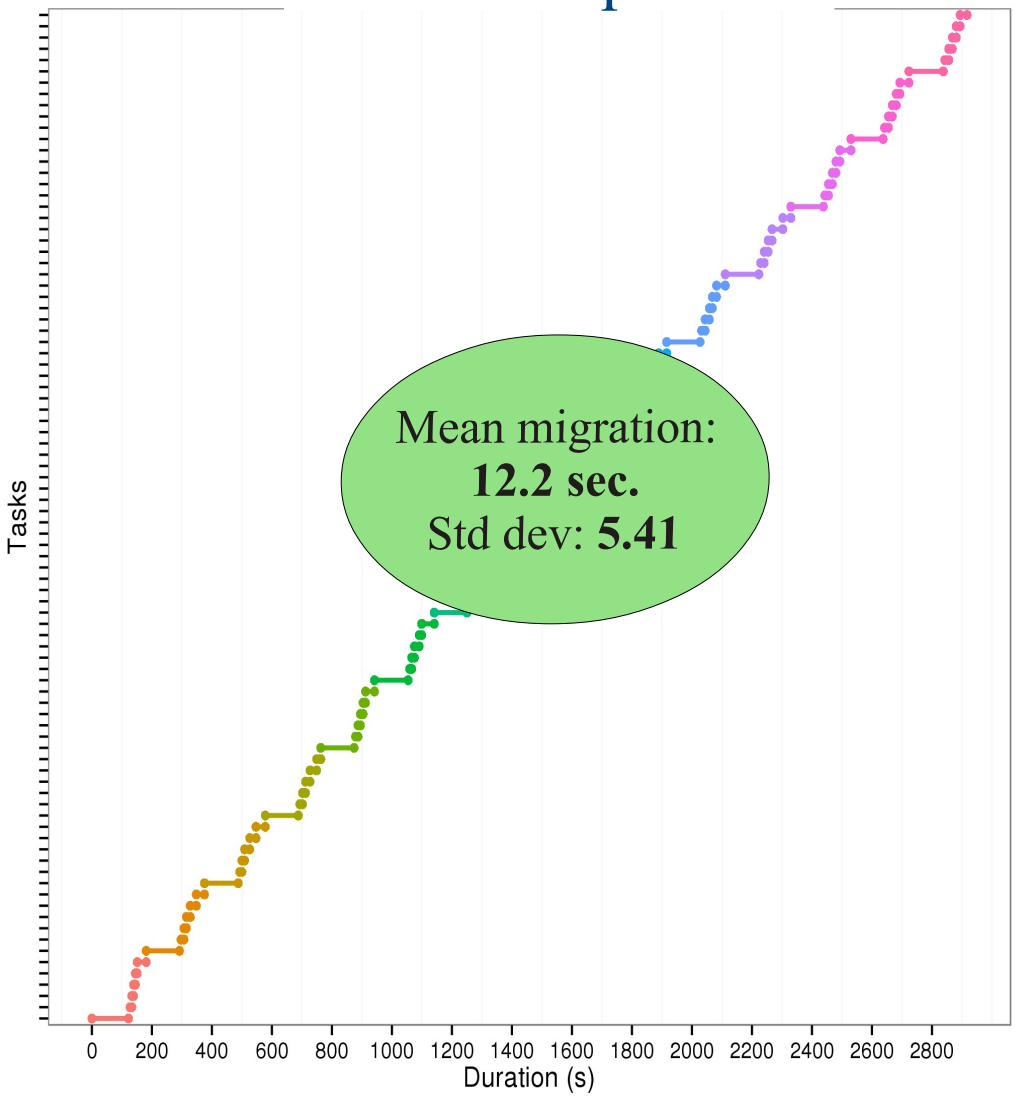

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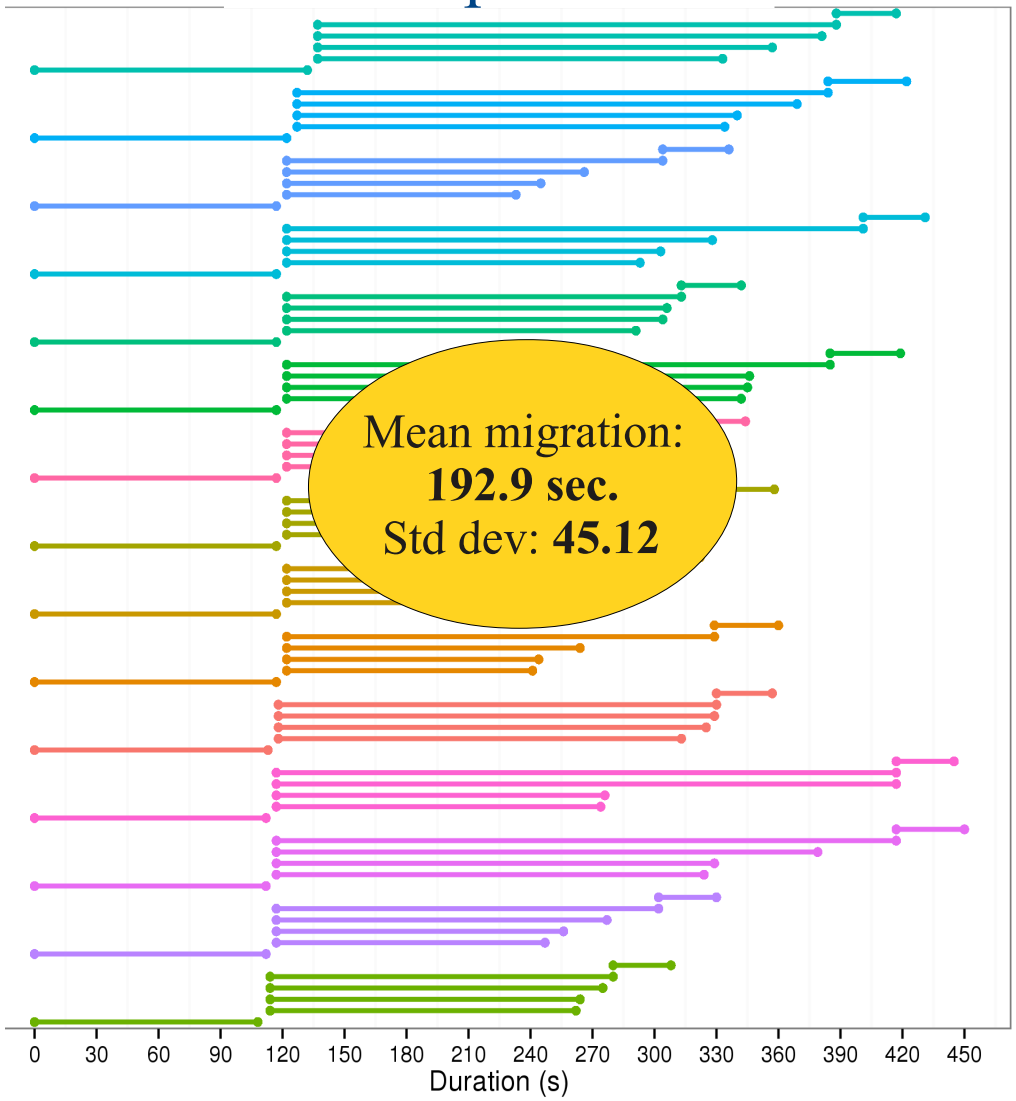
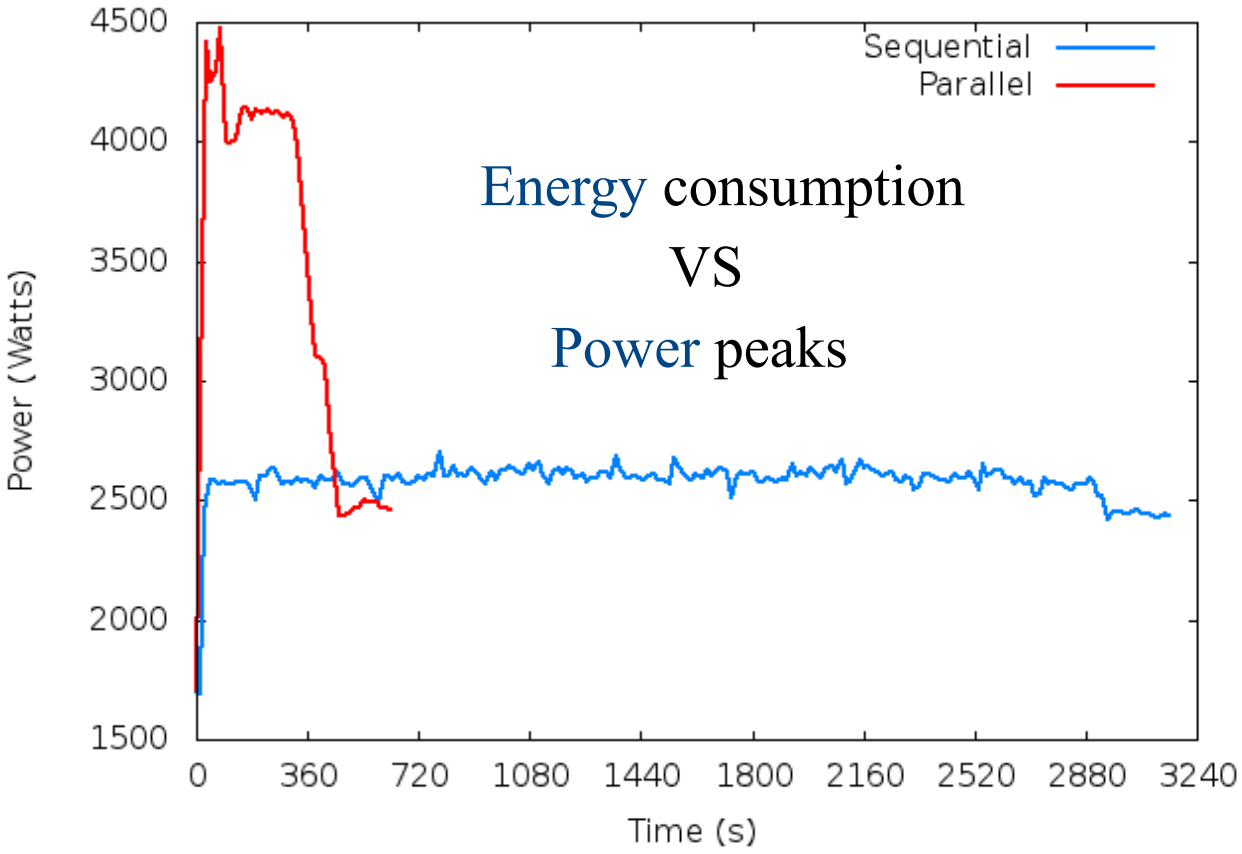


Energy consumption

- **Blade-center maintenance**



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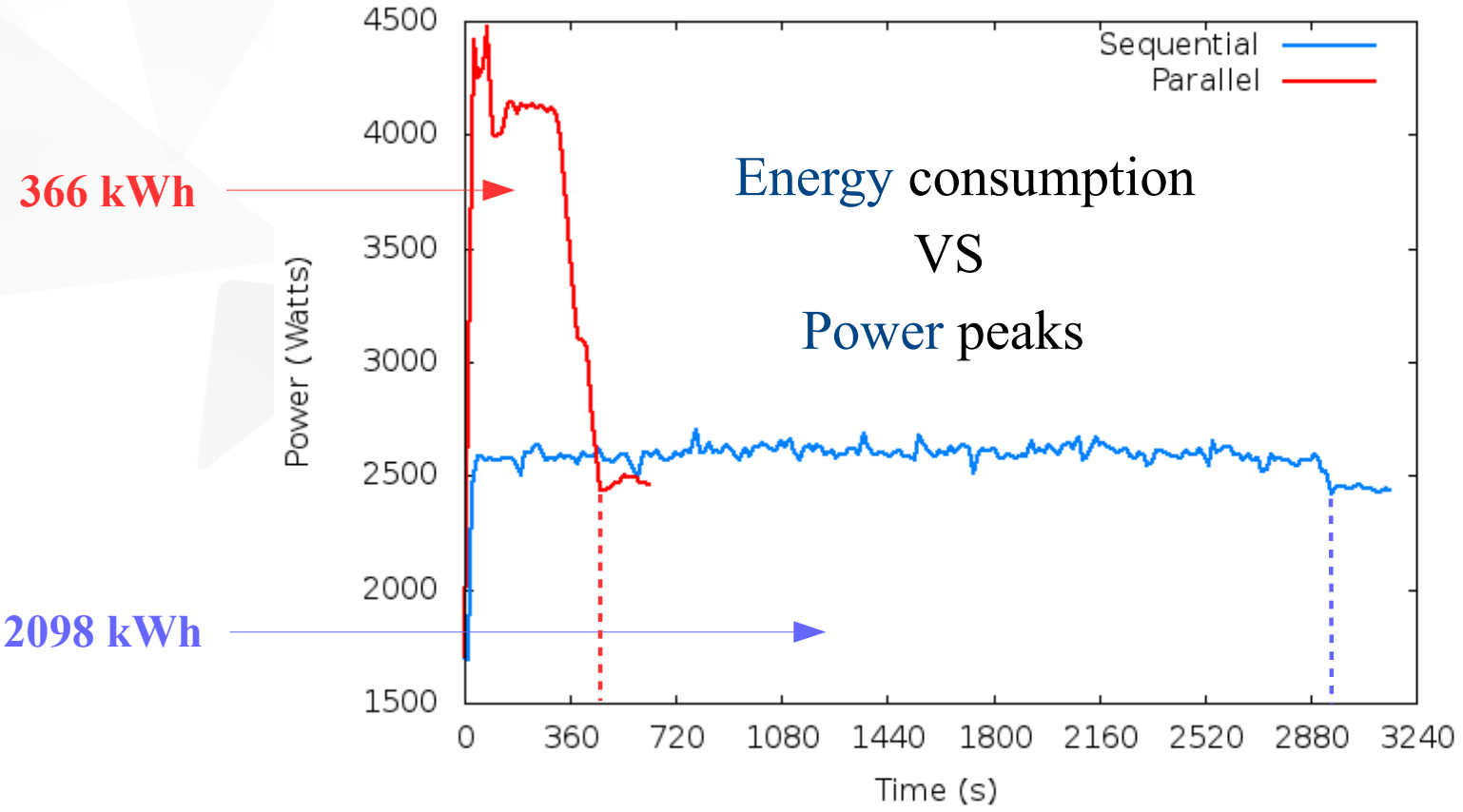
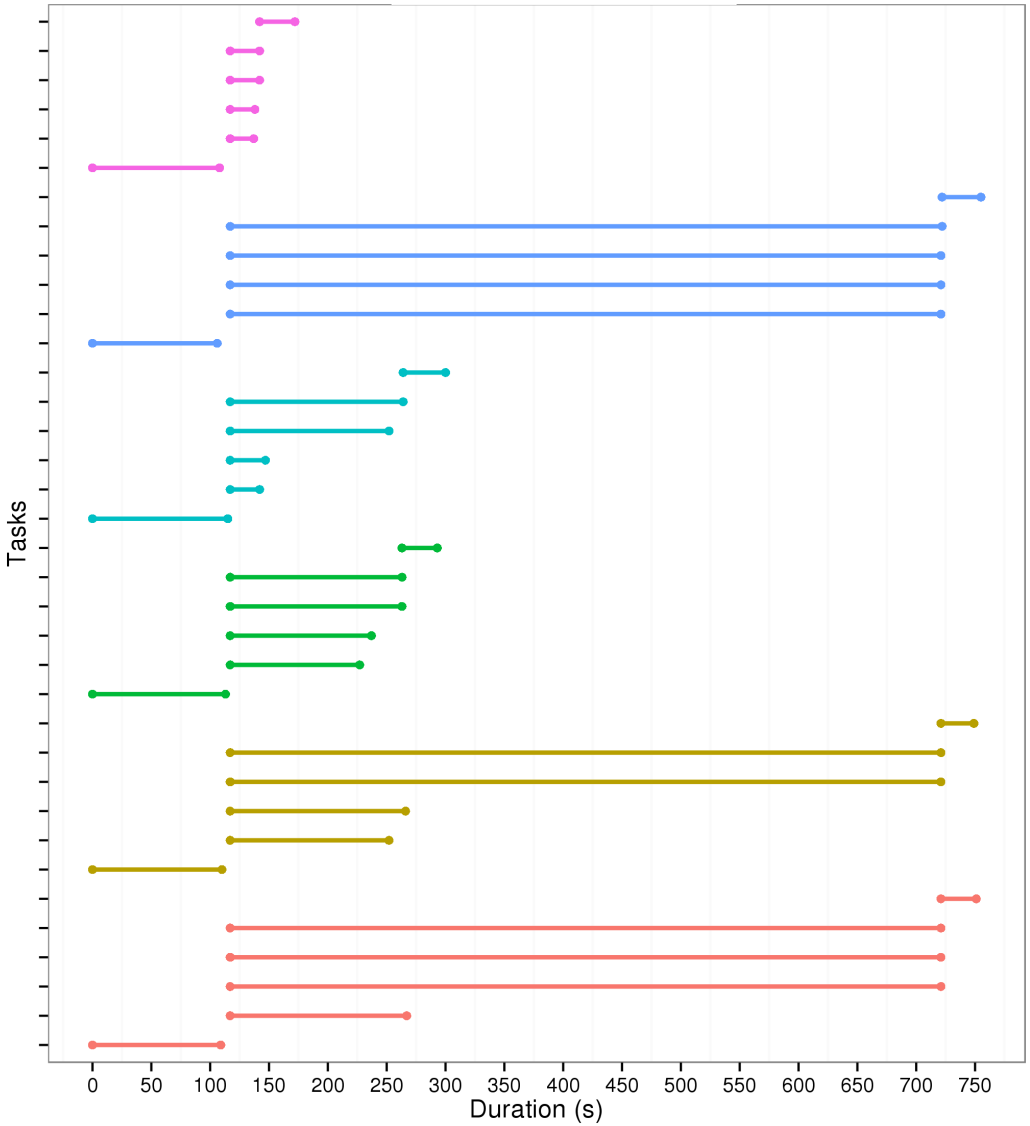


Neither of the two strategies is efficient

- No generic solution
  - It is a matter of trade-offs
  - Parallel / Sequential migrations
- Adaptive to the environment peculiarities
  - Network links capacity / topology
  - Workload specificities

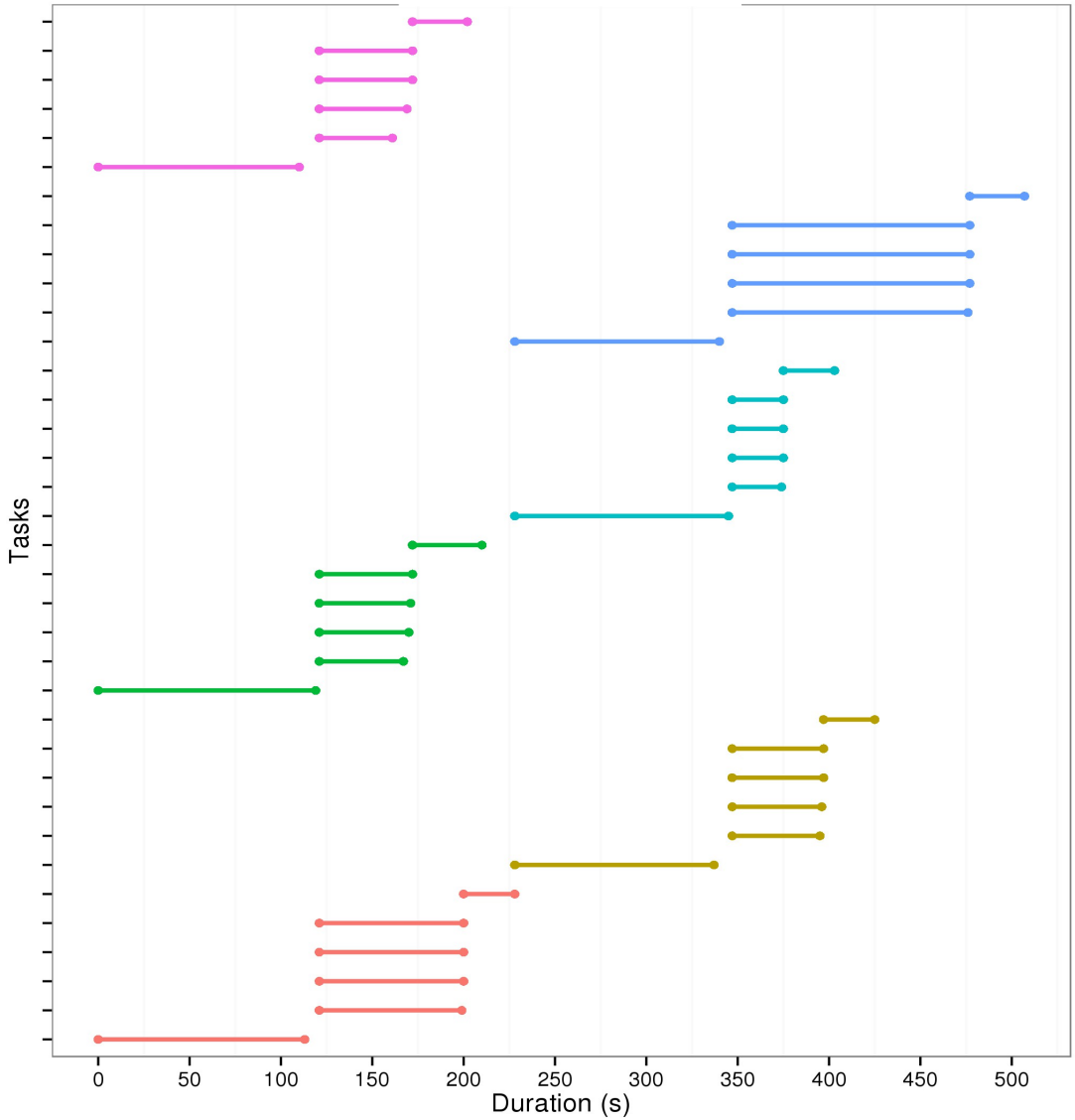
Adaptation to the interlink peculiarities



6 to 6 servers, 4 VMs per server
24 migrations

- Full parallel scenario
- Timeout: 10min
  9 cold migrations

Improvements – Interlink peculiarities



Nodes replaced 3 by 3

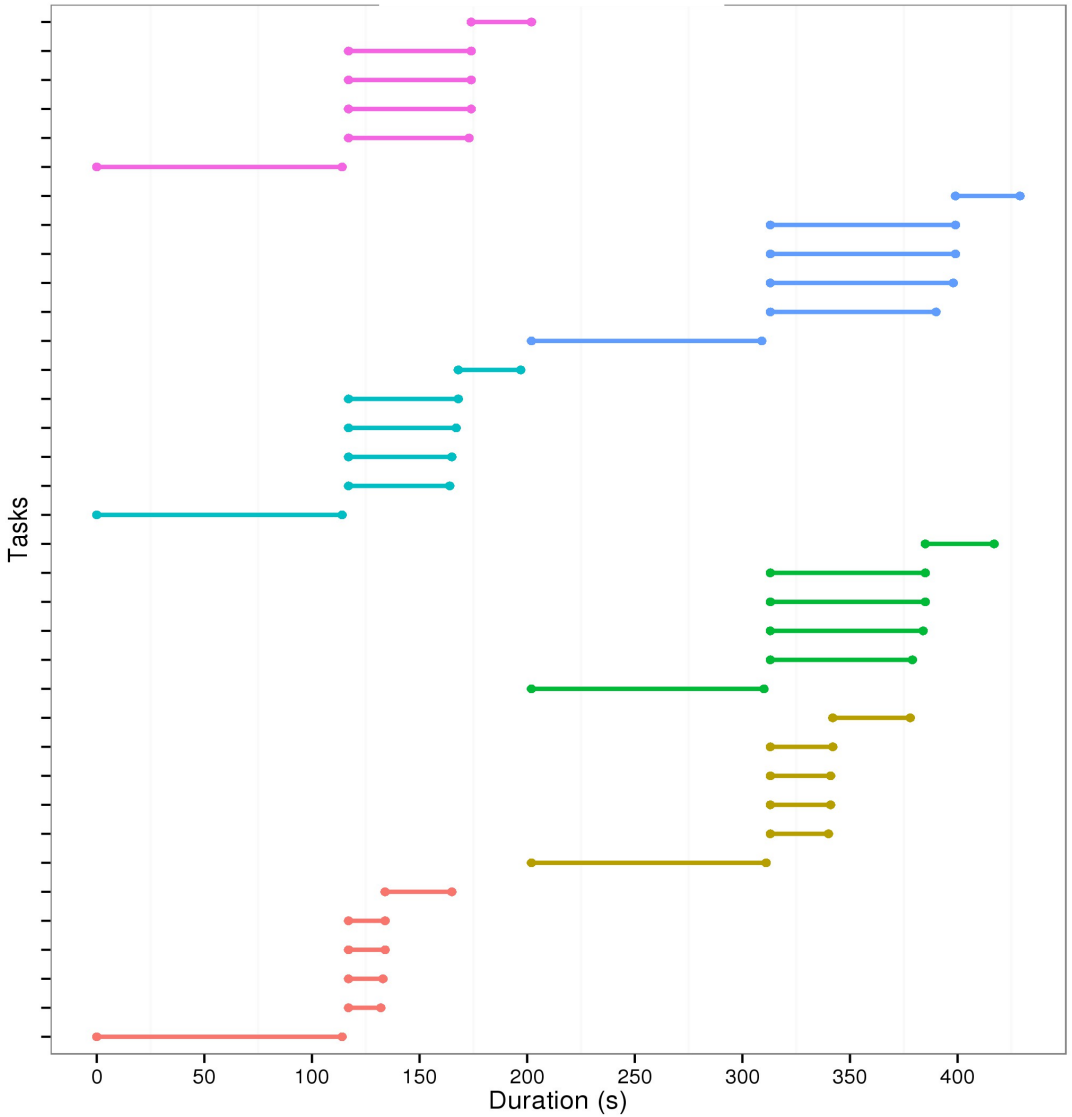
- Completion time reduced by 33%
- Migration times 4 times lower

- Better interlink usage

  No cold migration

- High std. deviation: 33.15 ?
  - **Aggregation not fair !**

Improvements – Interlink peculiarities



Ensuring fair aggregation

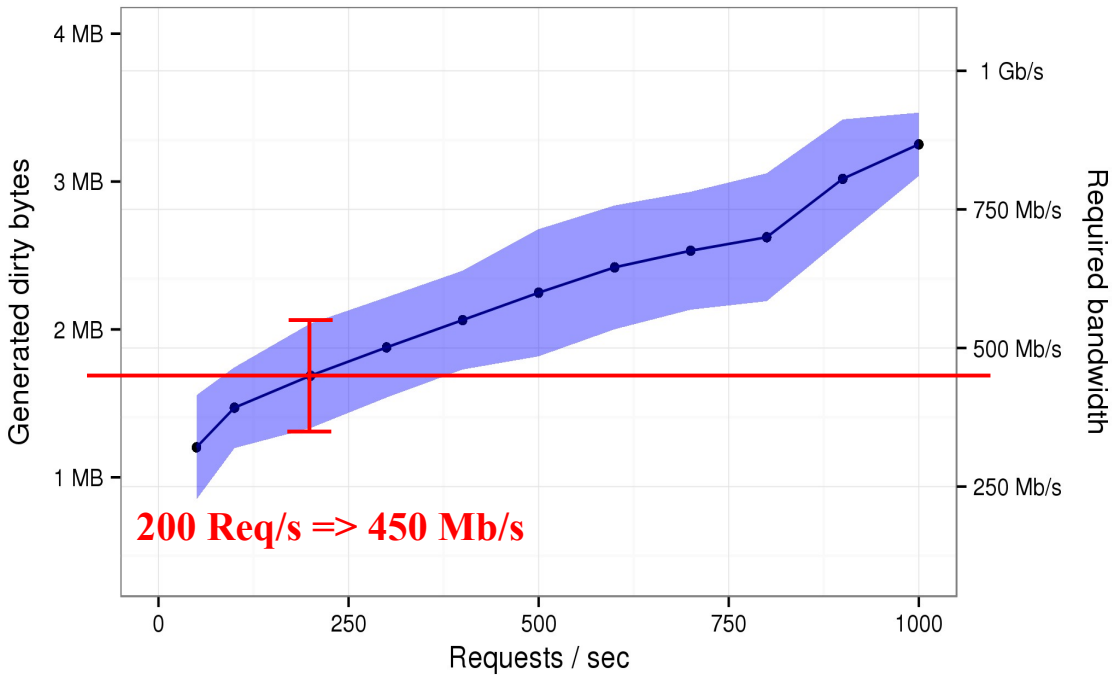
- Completion time reduced by 44%
- Migration times 5 times lower

- Still high std .deviation: 23.17

1Gb/s links saturated

Adaptation to the workload peculiarities

- How many migrations in parallel ?
- Wrt. the VM's dirty page rate:
  - KVM downtime: 30ms
  - Httperf workload



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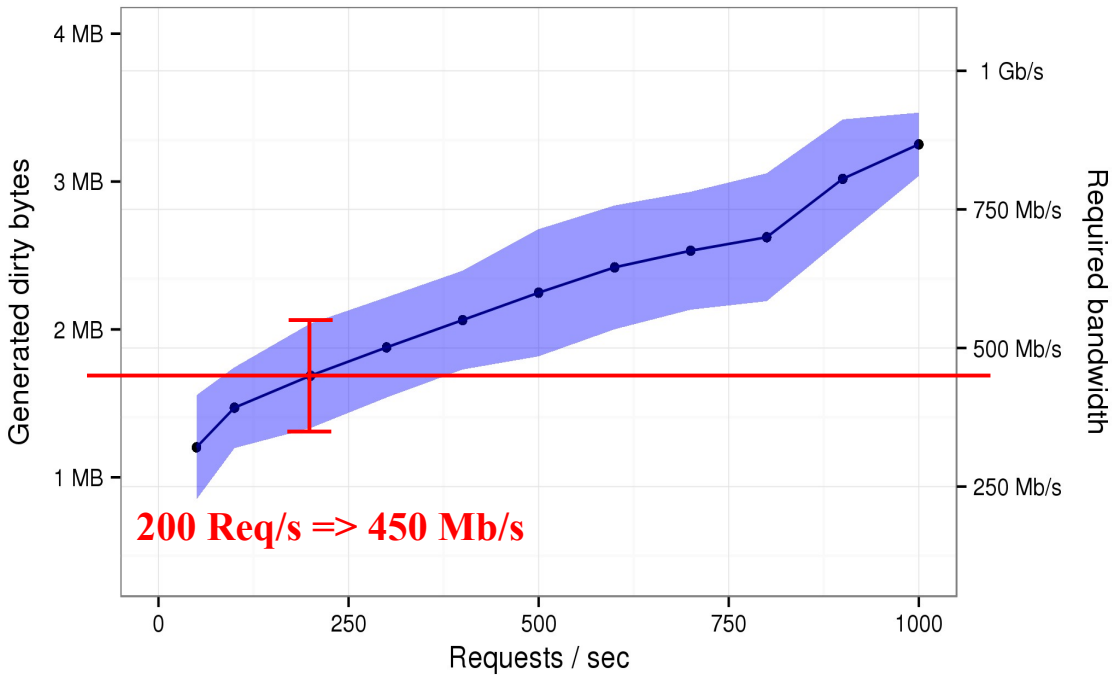
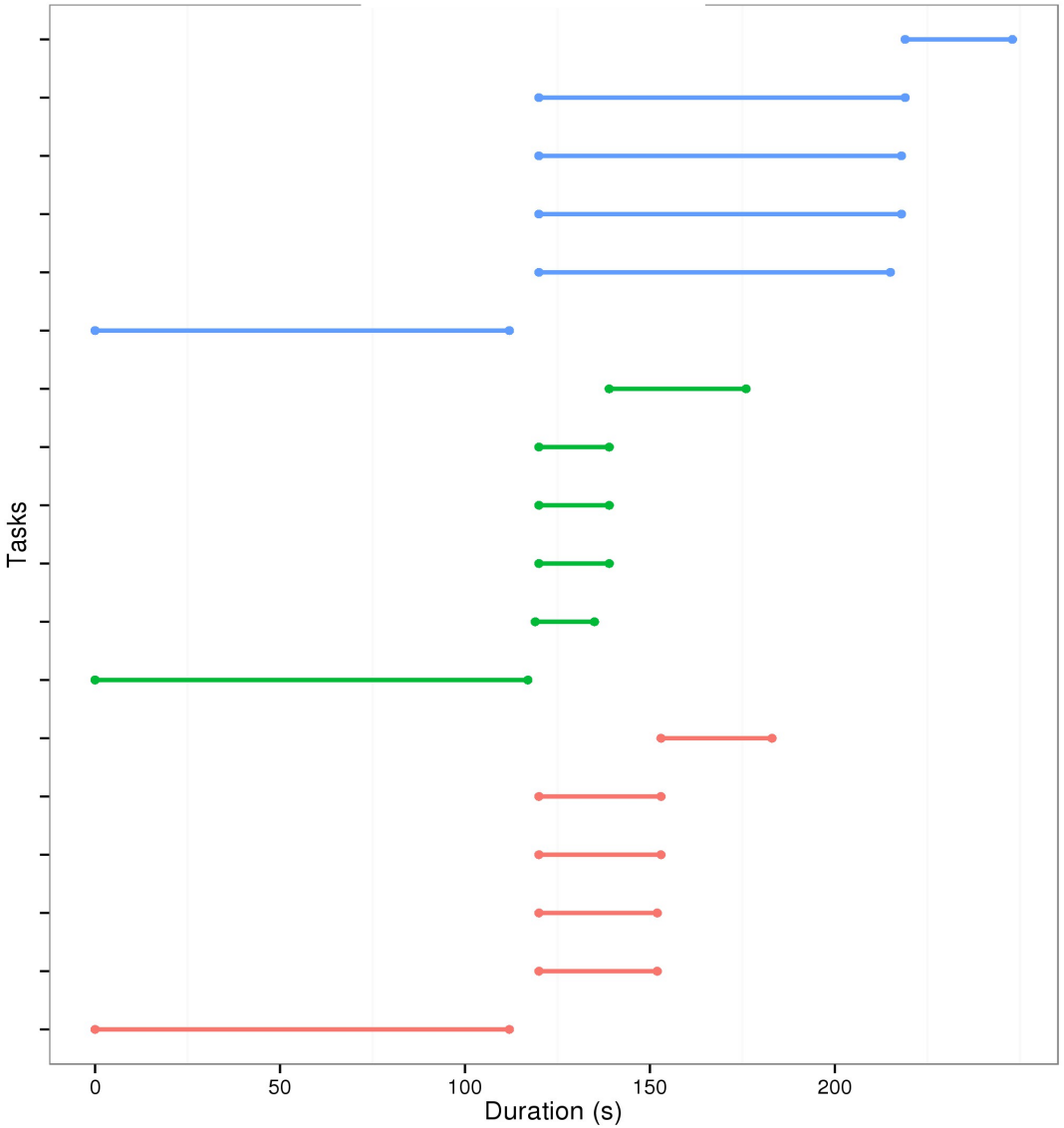


- **2 migrations max per 1Gb link**

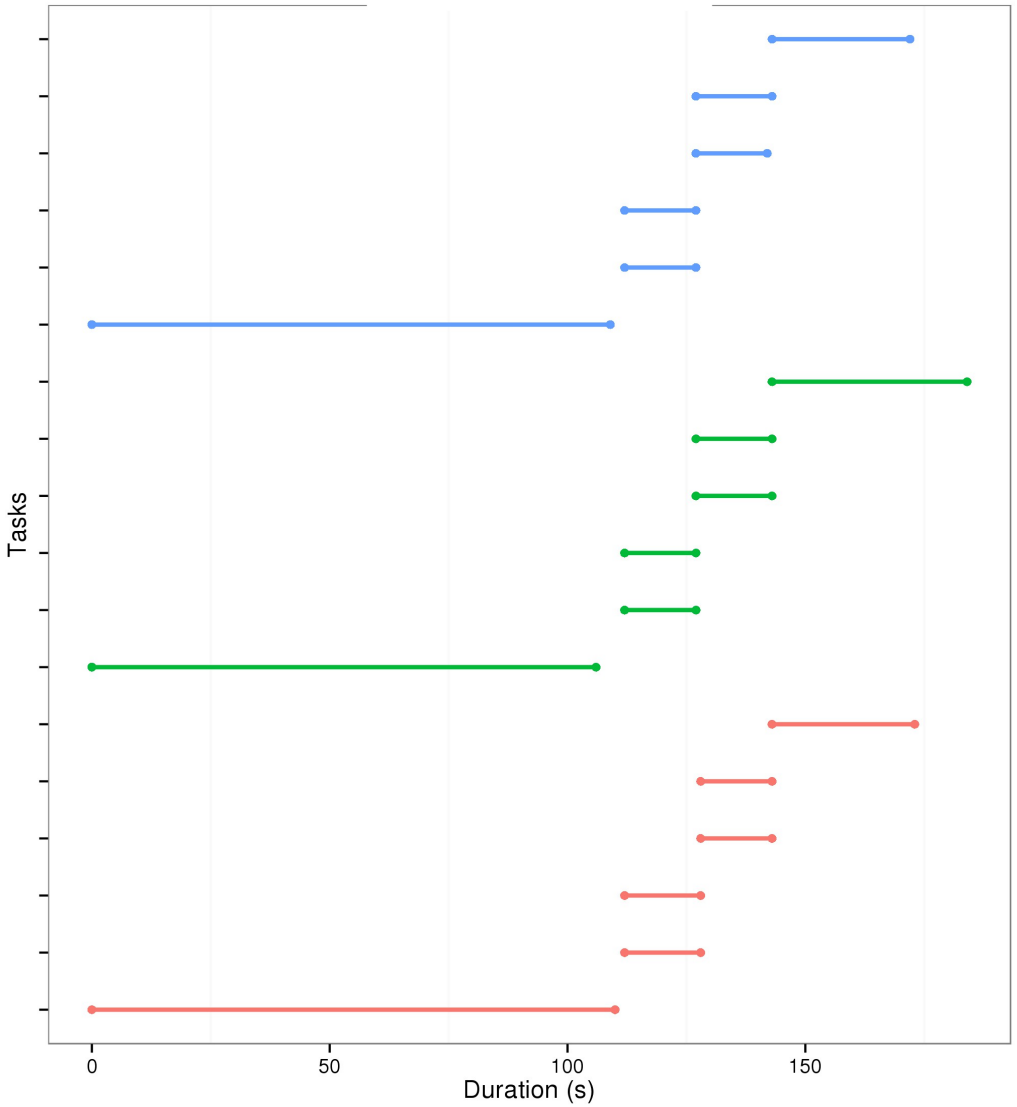
Improvements – Workload peculiarities



- 3 to 3 servers, 4 VMs per server
  12 migrations
- Full parallel scenario
- Mean migration duration :
  49.51 sec.

  Std.dev: 34.51

Improvements – Workload peculiarities



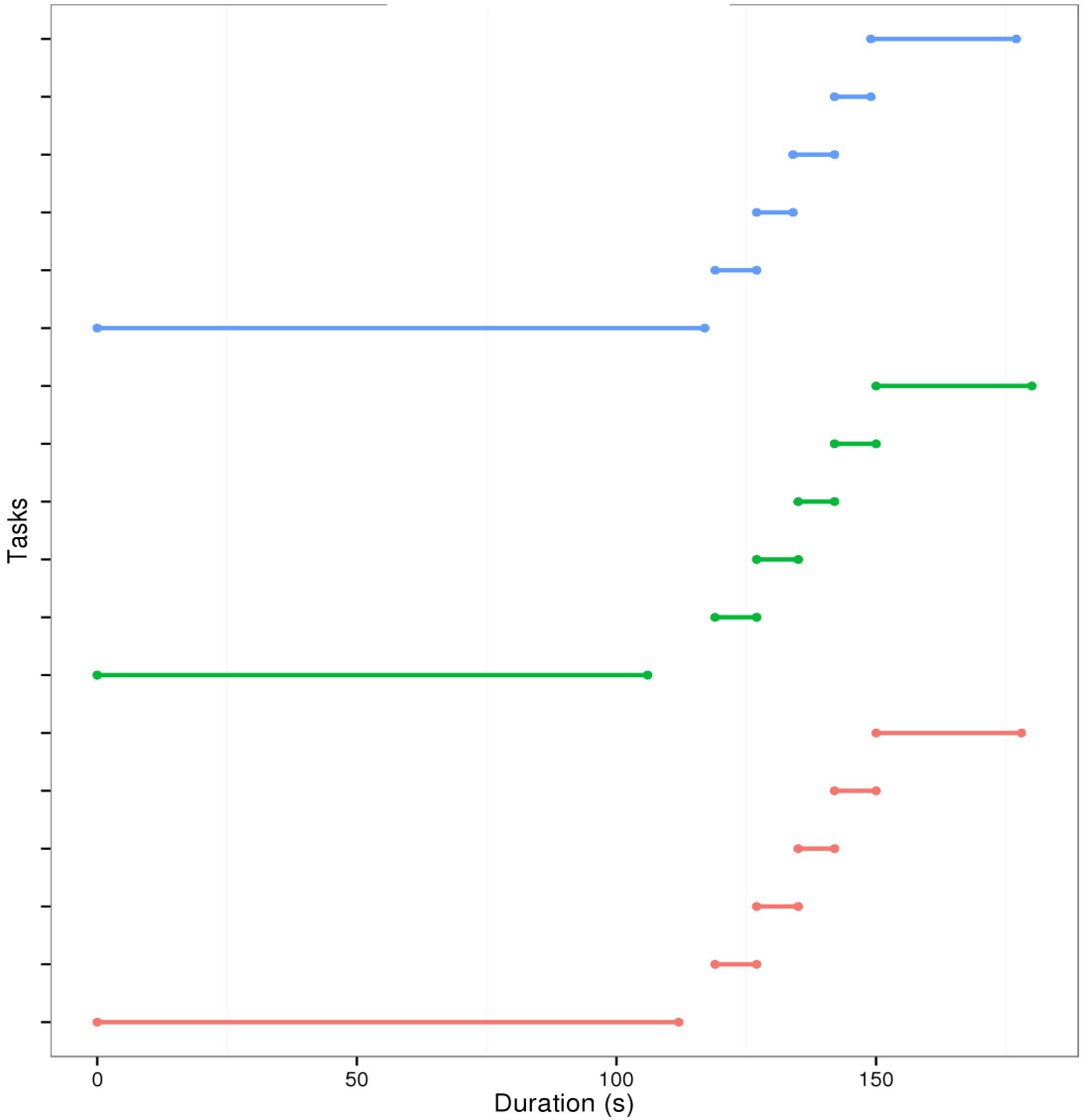
VMs migrated 2 by 2

- Mean migration duration : 15.41 sec.

  Std. deviation: 0.47

- Completion time reduced by 31%

Improvements – Workload peculiarities



VMs migrated 1 by 1

- Mean migration duration : 7.66 sec.

  Std.dev: 0.45

- Same completion time than previous

- But no one is better !
  - Depend on application context

Conclusion

- Based on good environment knowledge, we greatly improved the maintenance preparation efficiency.
- Prepare efficient migrations plans to maintenance preparation is complicated !
- To automate we need to be adaptive to the peculiarities:
  - Knowledge of the environment
  - Highly dependent of specific metrics

Future works

- Model the aspects of a migration plan
  - Dirty page rate
  - Network topology
  - Estimated migration durations
- Model interaction with external side constraints
  - Power budget, Completion deadline, Licensing policy, ...
- Implement the model over the VM manager
  - Composable VM placement algorithm
  - Support side constraints expressed by operators

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