Communication-Aware Application Placement in Combined Fog-Cloud Computing

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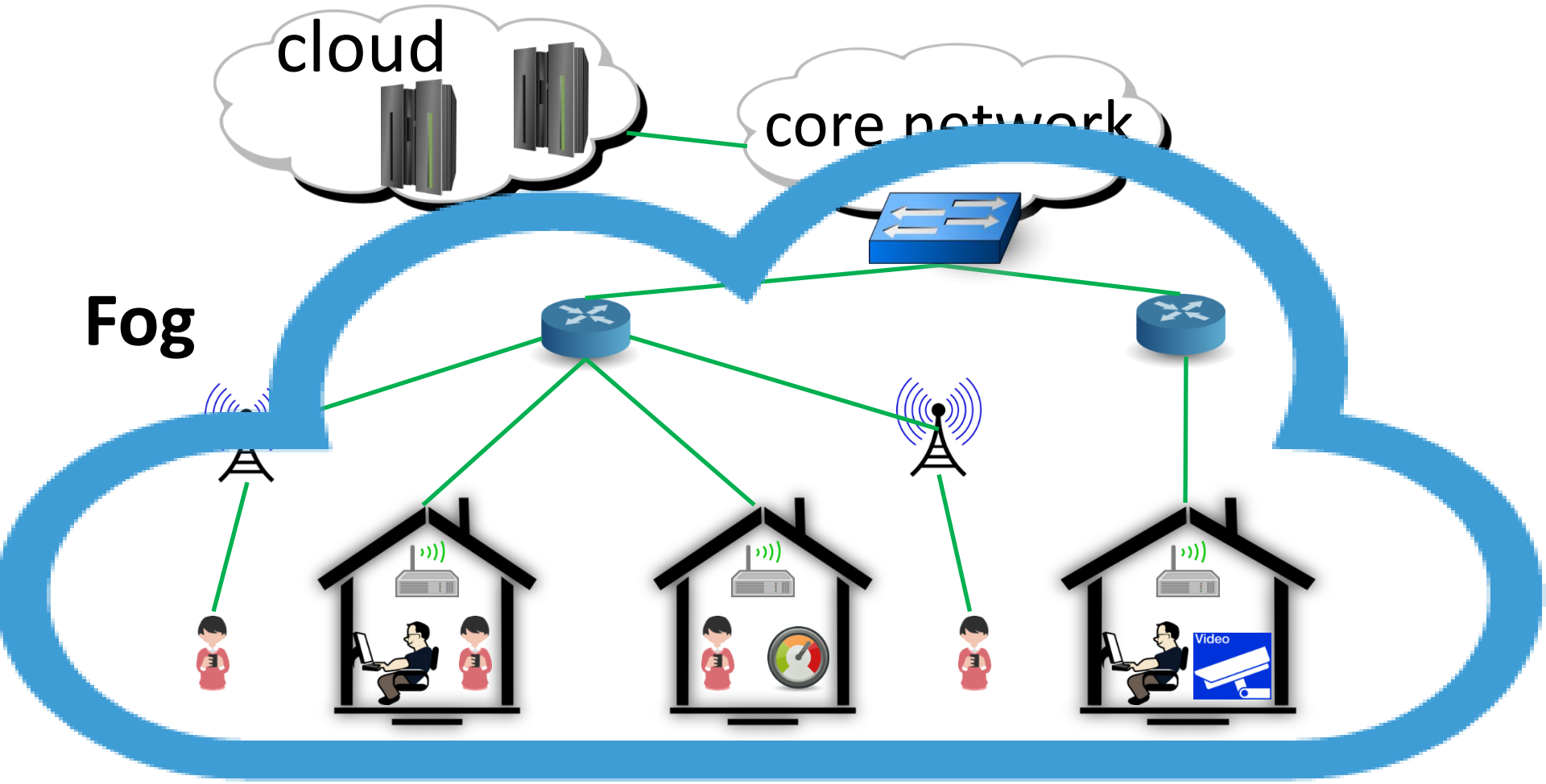
This talk contains material from François-Gaël OTTOGALLI , Pascal DECHAMBOUX from Orange Labs

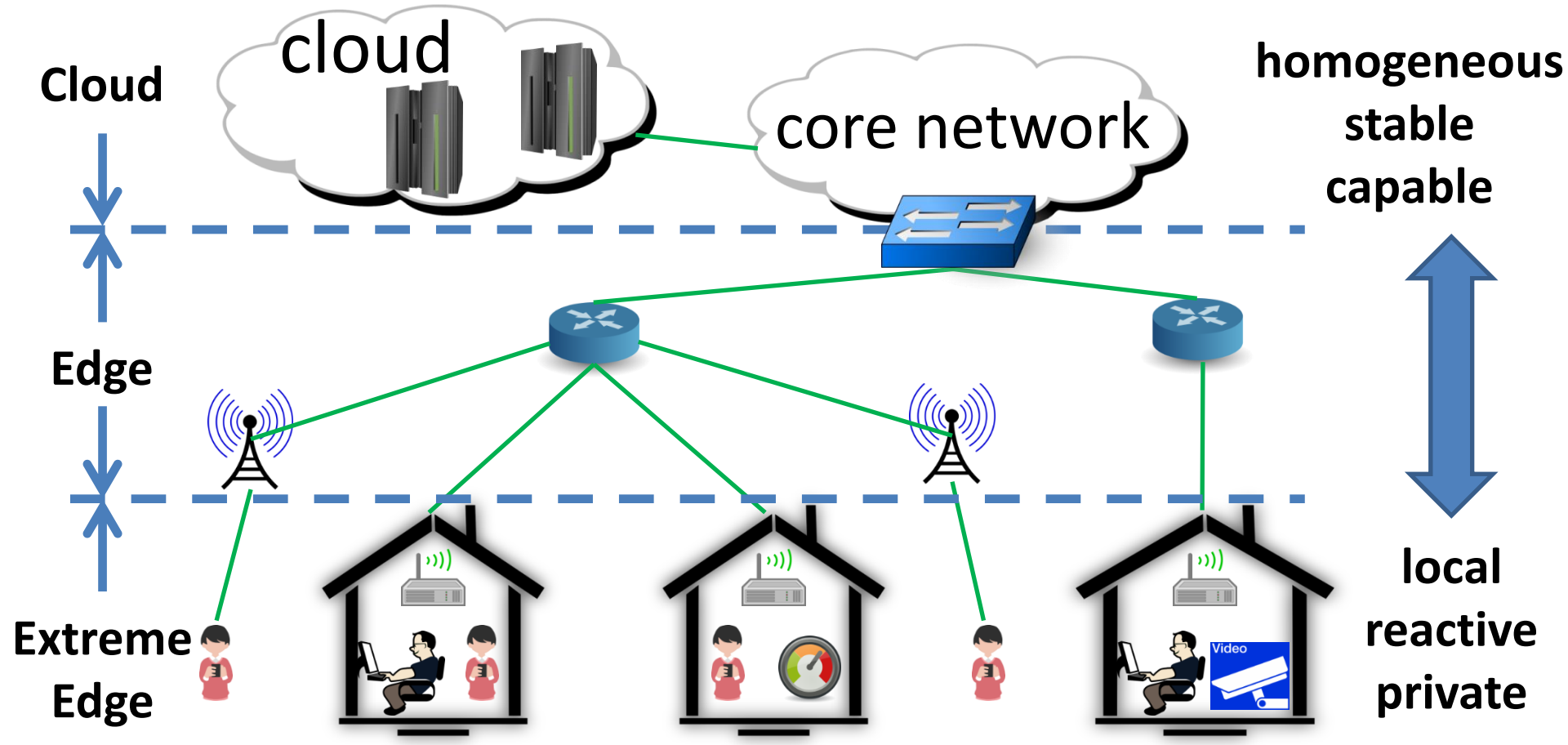
Outline

Outline

Context - Infrastructure

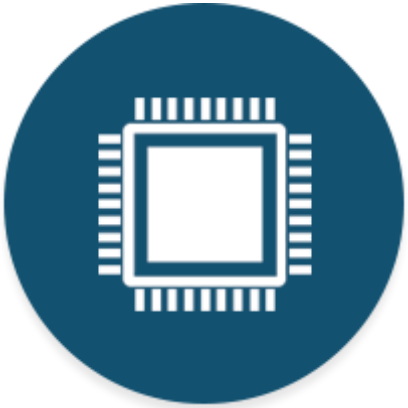


Context - Infrastructure



Outline

Model

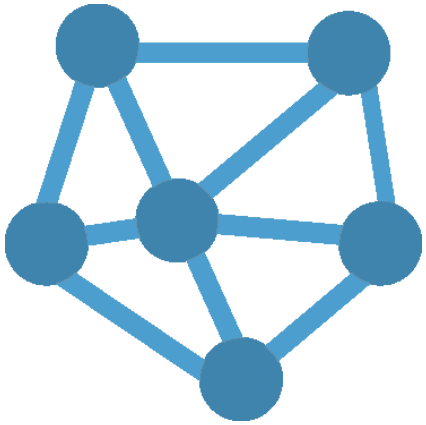


Compute

CPU (FLOPS)
RAM

Storage

DISK

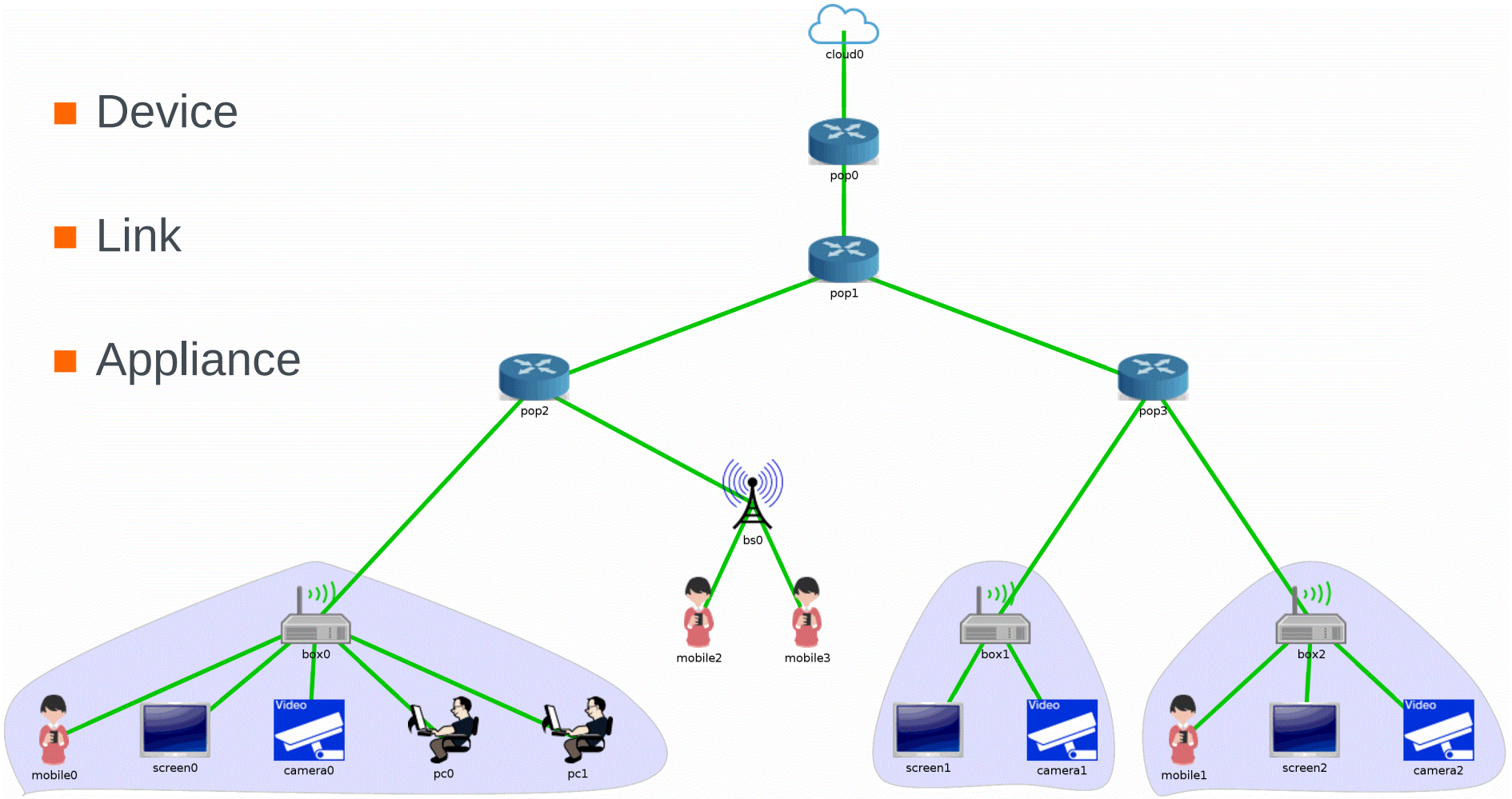


Network

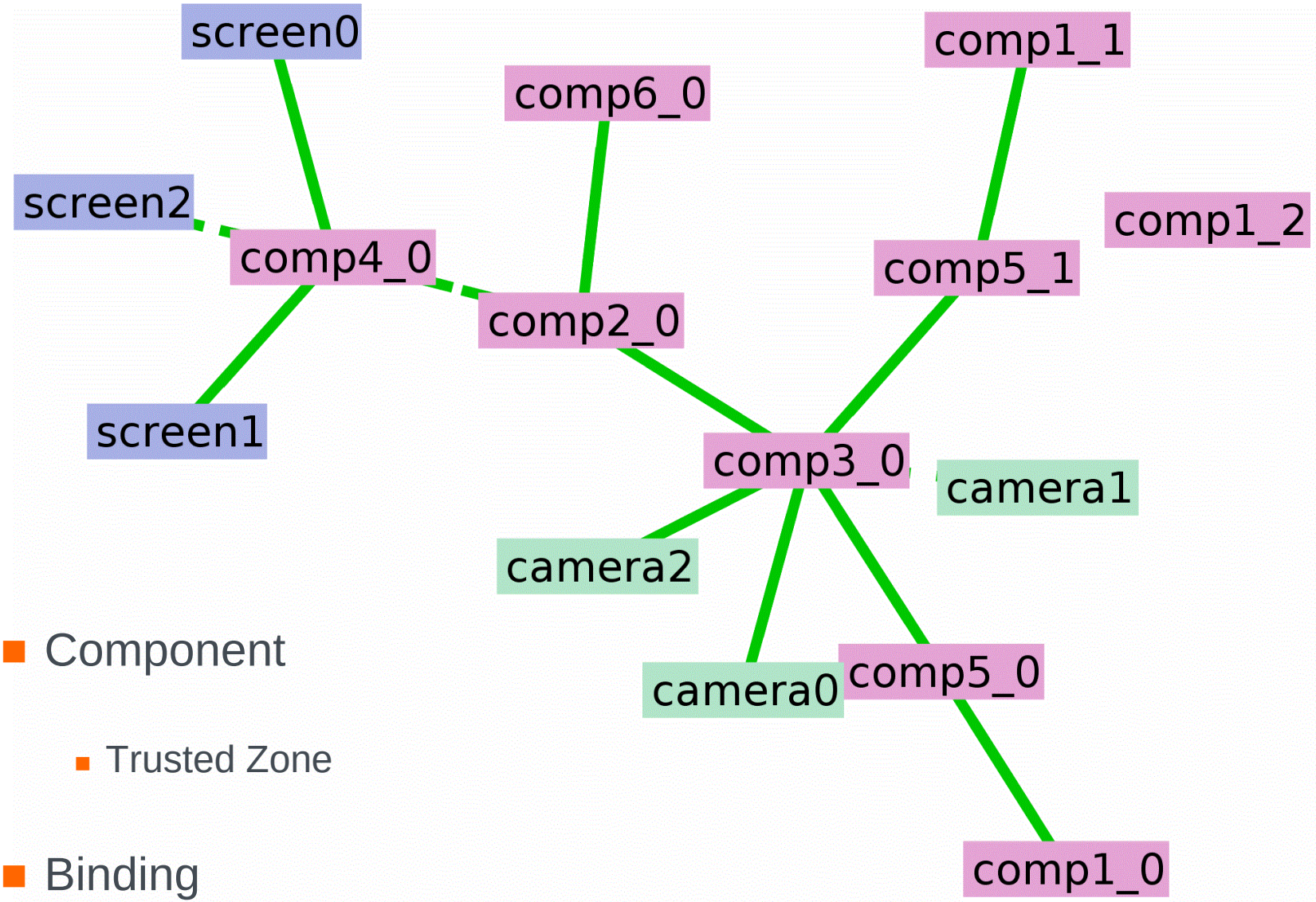
Latency
Bandwidth

Model - Infrastructure Model

- Device
- Link
- Appliance



Model - Application Model



- Component
  - Trusted Zone
- Binding

Outline

Placement - Constraints

Placement Constraint

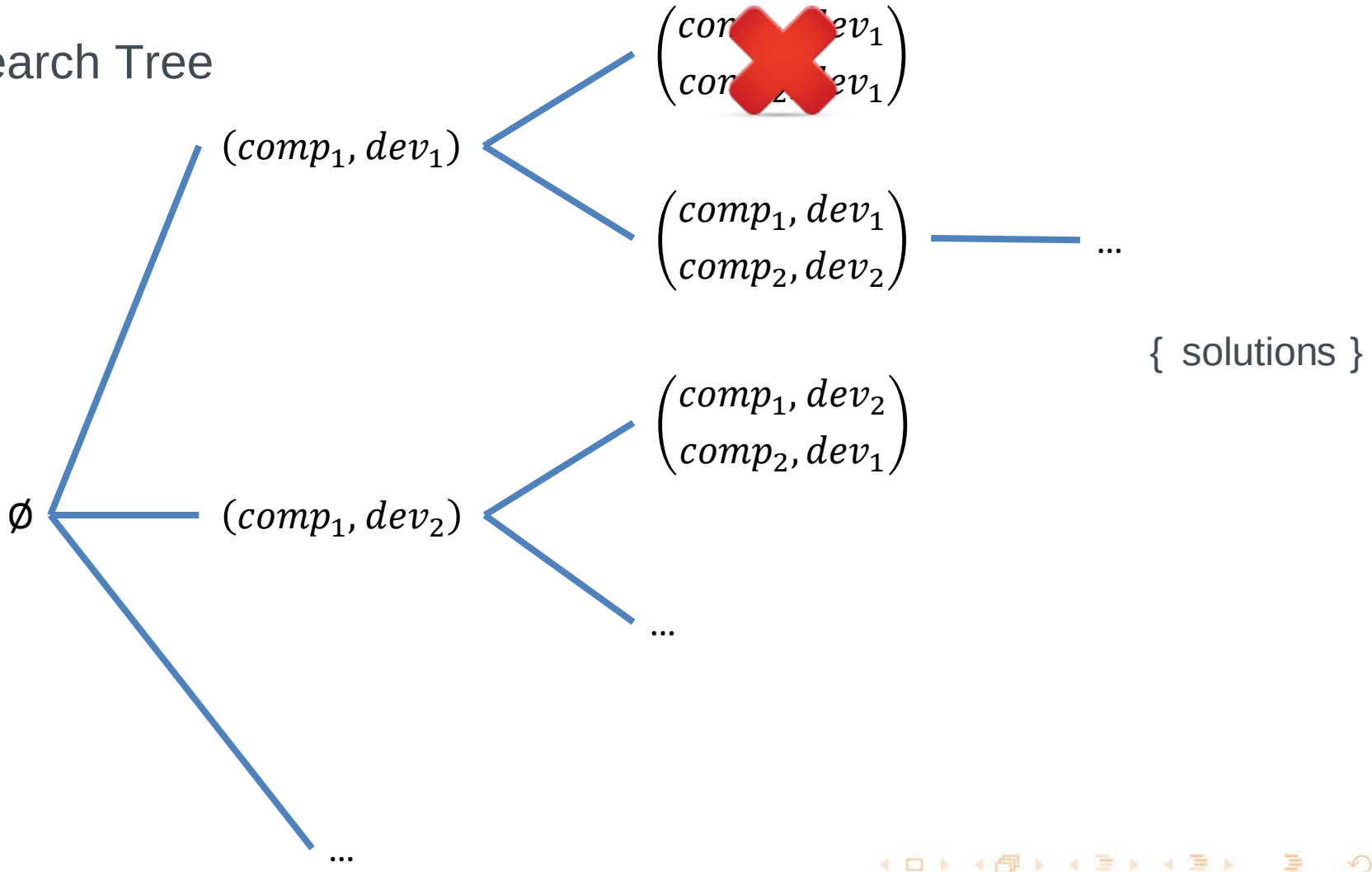
- Each component is placed in a device

Solution Constraint

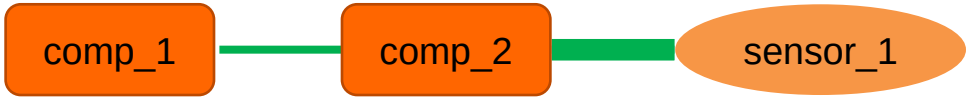
- Consumption of Compute & Storage Resource
- Consumption of Bandwidth
- Latency
- Trusted Zone

Placement - Solution Search

- Backtracking algorithm
- Search Tree



Placement - Solution Selection



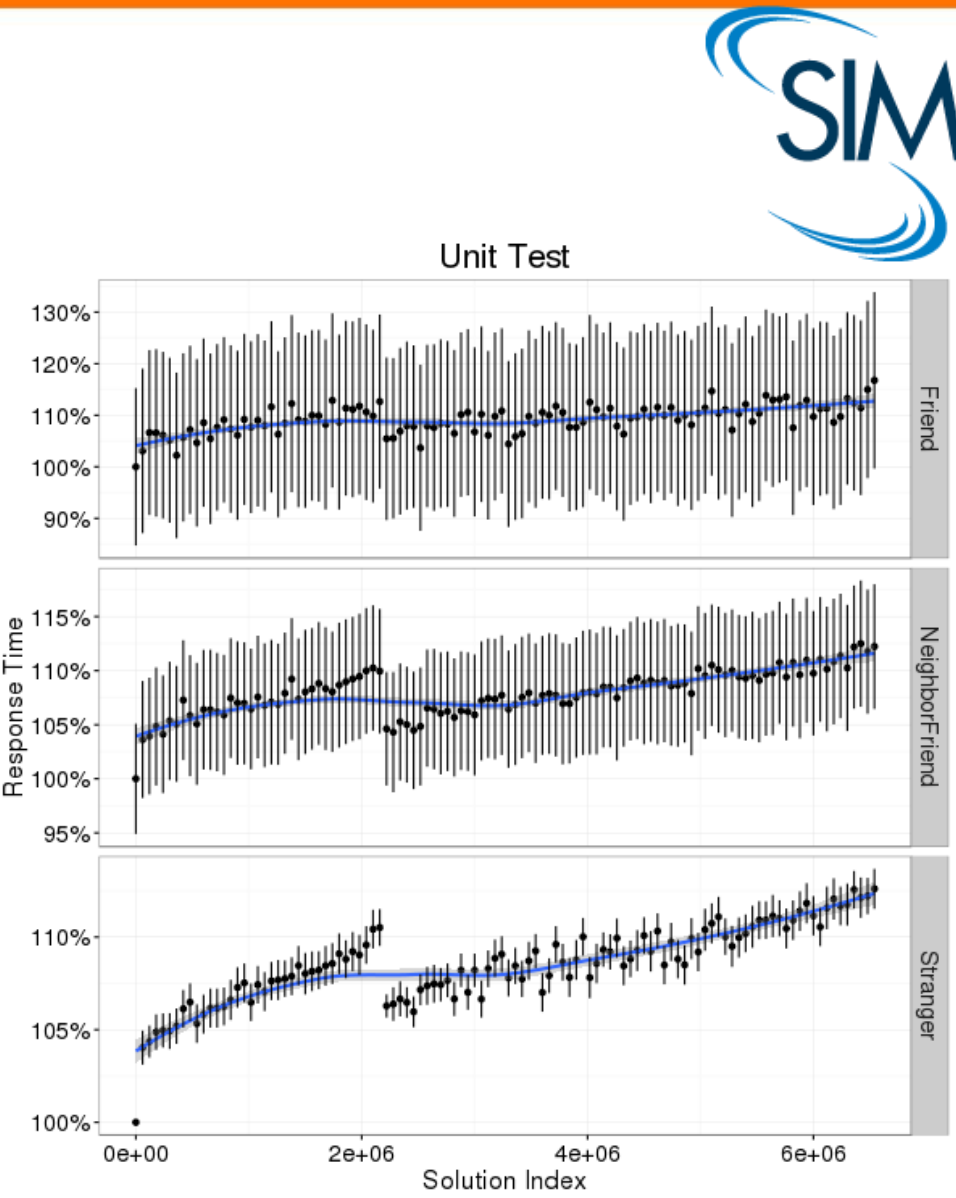
weighted average latency

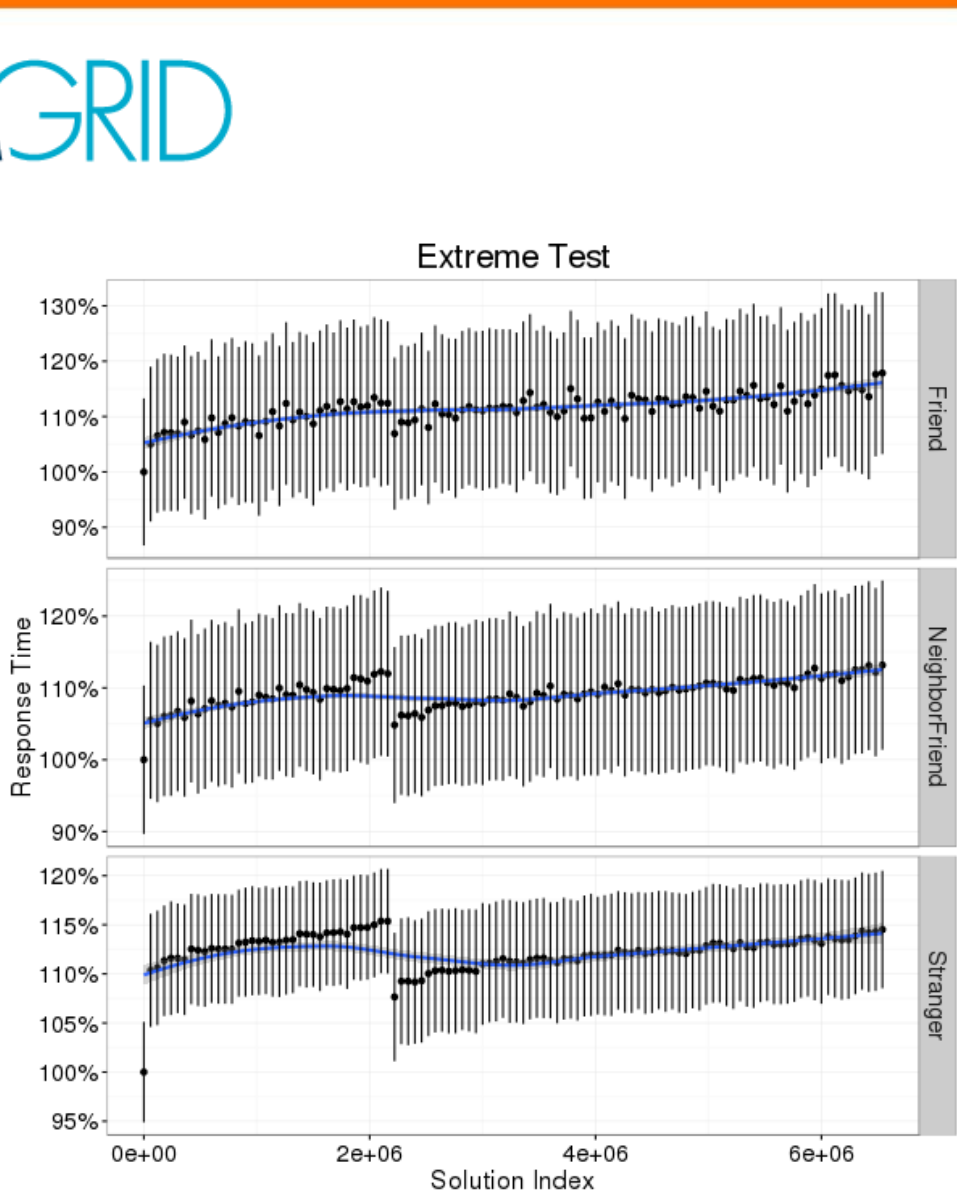
weight : $\frac{bw(bind)}{bw(app)}$

$$w\_avg\_lat(app) = \sum_{bind} \left(lat(bind) * \frac{bw(bind)}{bw(app)} \right)$$

$$minimize : w\_avg\_lat(app)$$

Placement - Evaluation





Outline

Heuristics

Searching Algorithm

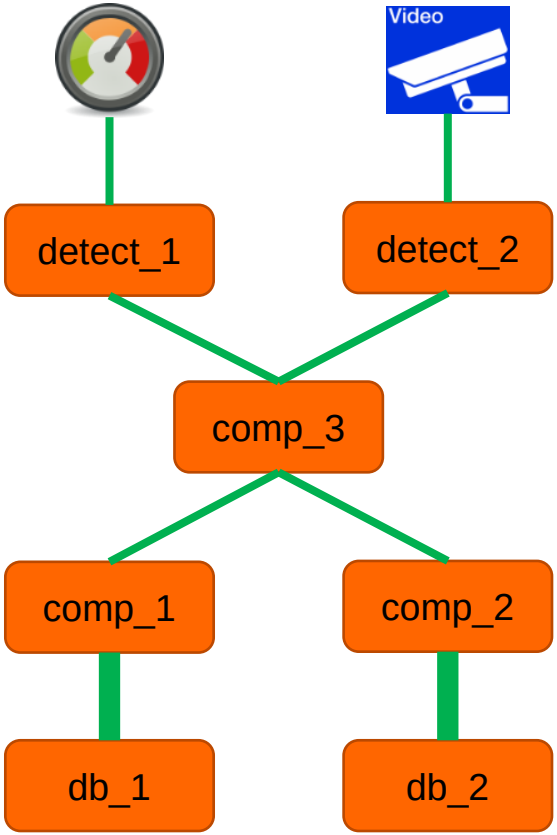
- Depth-First
- Random-Order test

Target Device

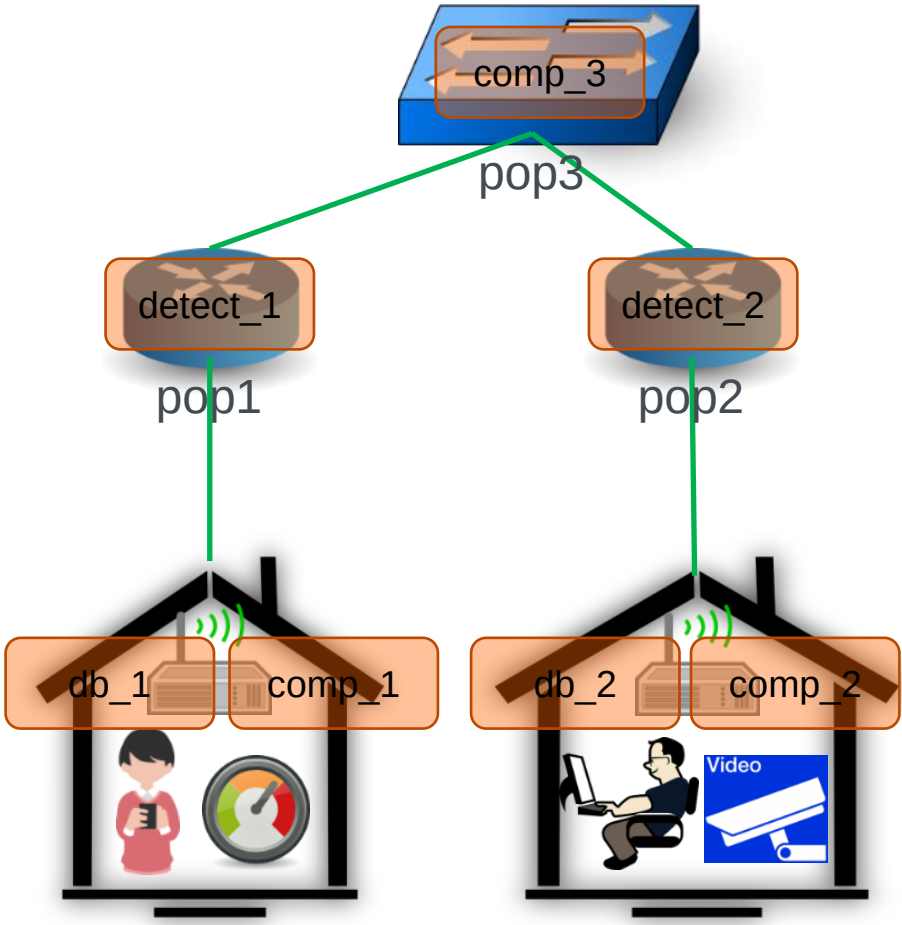
- Avoid whole-searching
- Sort candidate devices
- Evolution process
- Consider only Trusted Zone

Heuristics - Evolution Process Example

comps2evolve: comp_1 | comp_2 | comp_3 | detect_1 | detect_2 | db_1 | db_2



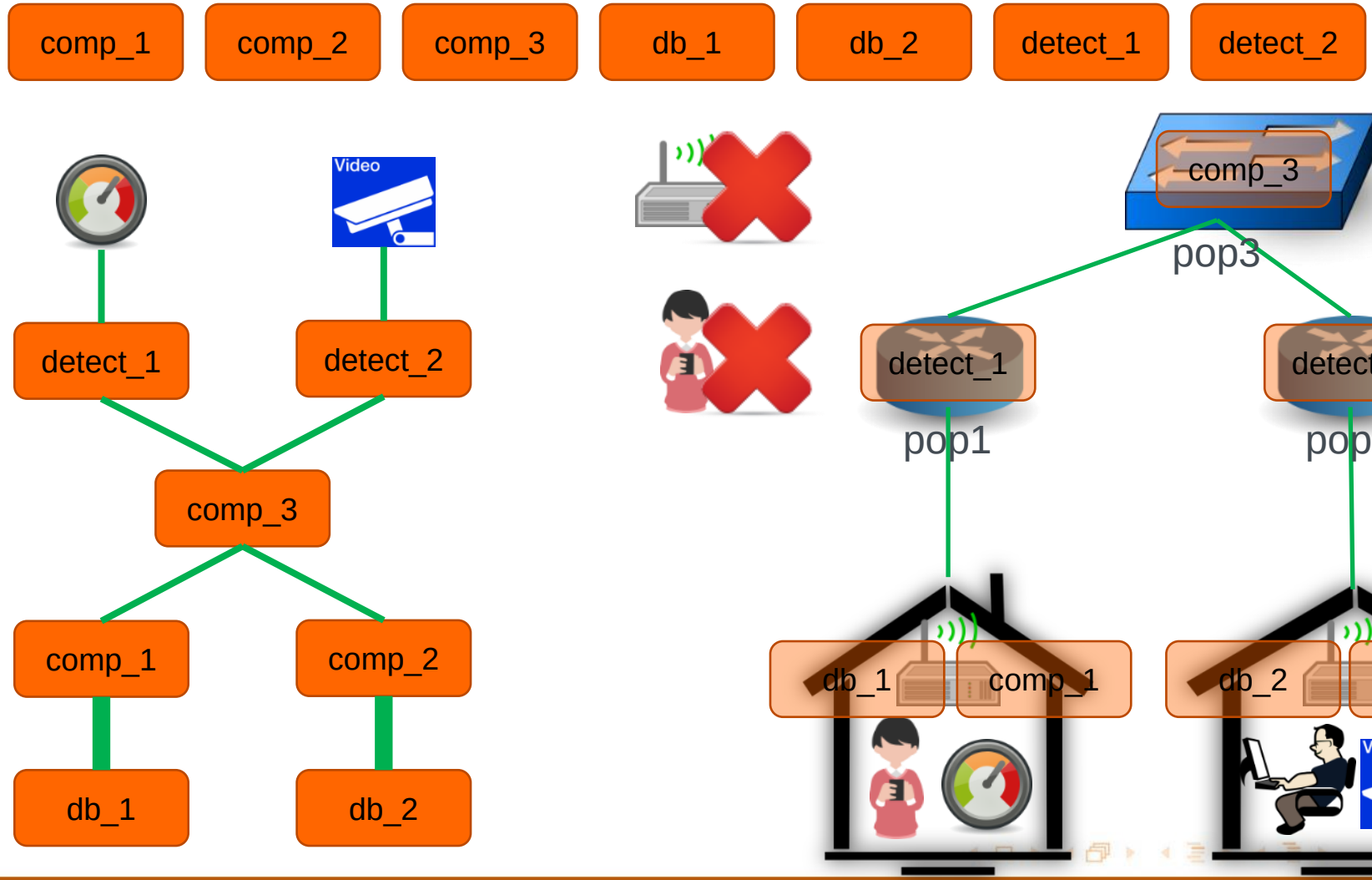
$$\sum_{bind \in getBinds(comp)} \left(lat(bind) * \frac{bw(bind)}{bw(app)} \right)$$



Heuristics - Solution Search Acceleration

- Critical compute/storage resource – dynamic priority

comps2place:



Heuristics - Evaluation Setup

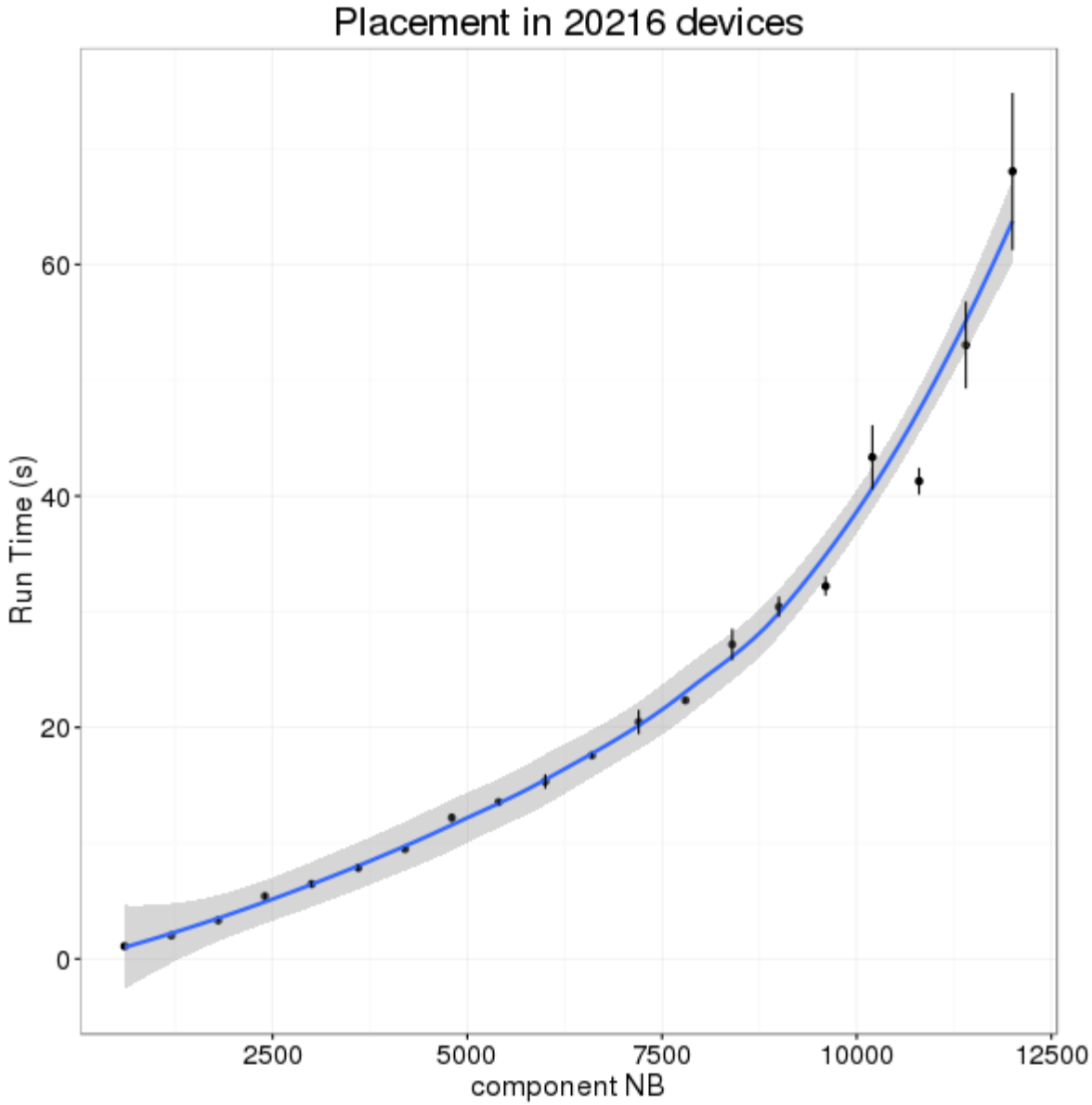
NB(Cloud) : NB(Edge) : NB(Extreme) = 1 : 10 : 1000

Trusted Zone	Full	House
Comp NB Proportion	1	5

$1 \leq \text{Size(House)} \leq 3$

CPU	Intel i5 - 5300U @ 2.3 GHZ
RAM	16GB
OS	Windows 7 Enterprise
JAVA Version	1.7.0_80

Heuristics - Evaluation with Fixed Infra



Heuristics - Evaluation with Fixed App

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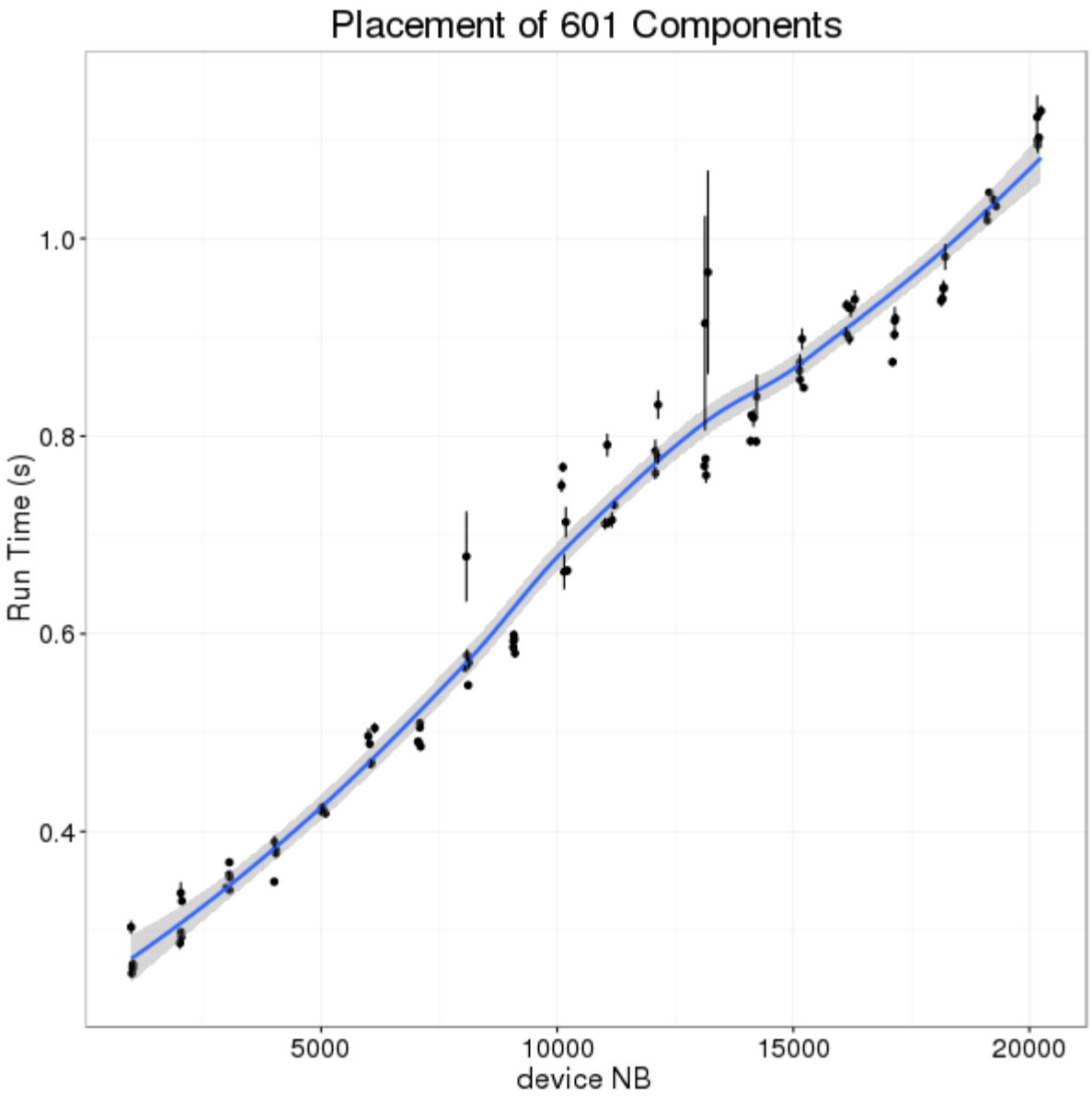
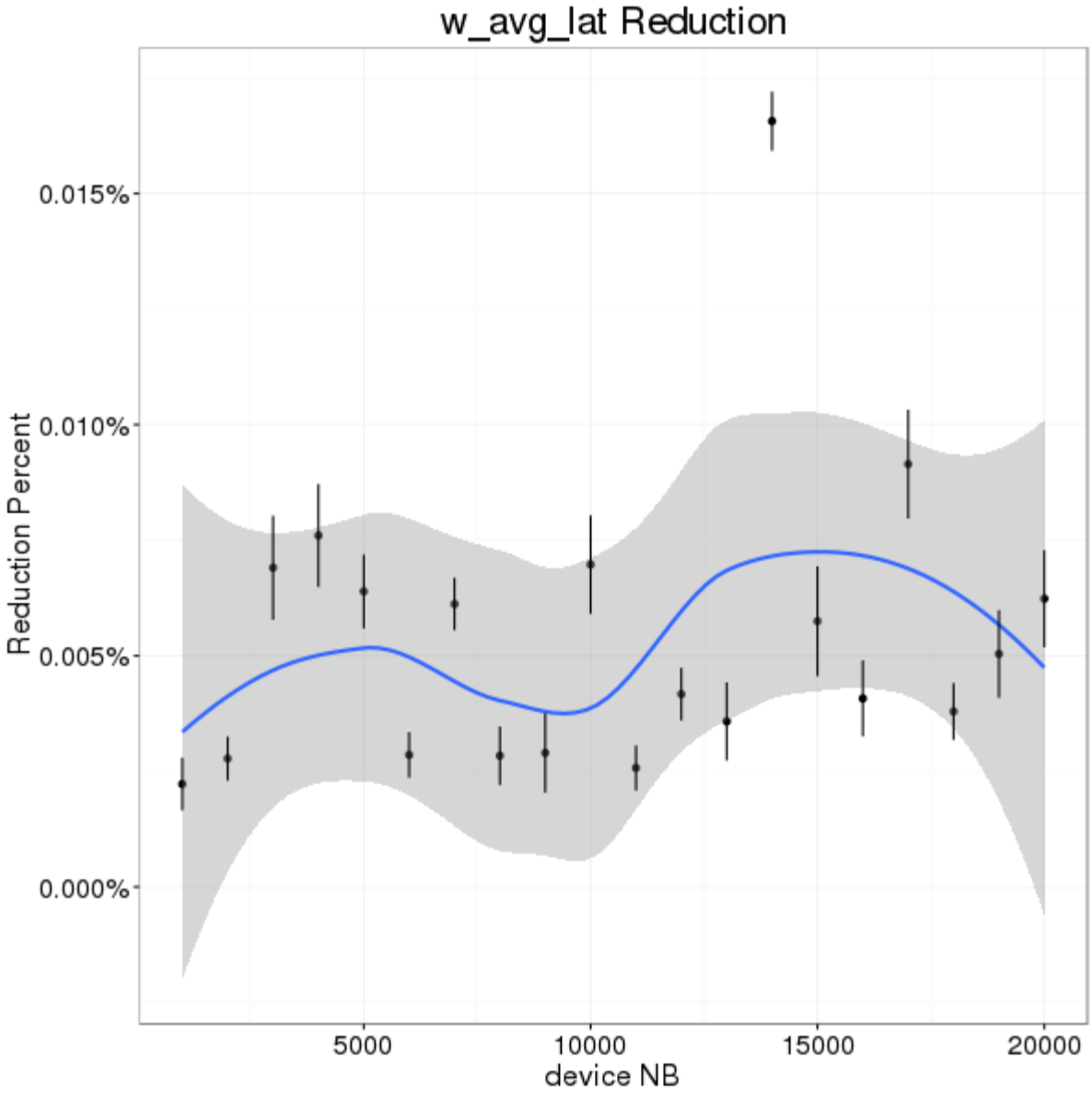


Heuristics - Evaluation with Fixed App

timeout : 5min



Outline

Future Work

Solution Search Acceleration

- Critical Latency
- Critical Bandwidth

Evaluation

- Avoid Garbadge Collection

Thanks for your attention