ANR Marmote
Workpackage 5, Task 5.1 : Network Dimensioning for Cloud Computing Environments

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Equipe Méthodes

Goals

- Analysis of complex Markov chains (large state space) :
  - Numerical simulations
  - Perfect and Parallel simulations
  - Stochastic comparisons : bounding aggregations, stochastic monotonicity
- Applications : Modeling and performance evaluation of cloud computing environments

Structure

- Lead : J.-M. Fourneau + H. Castel-Taleb
- Participants : M. Lourdiane, J. Jakubowicz, Alcatel-Lucent personnel (external)
- Effort : 41 man-months

Cloud computing infrastructure
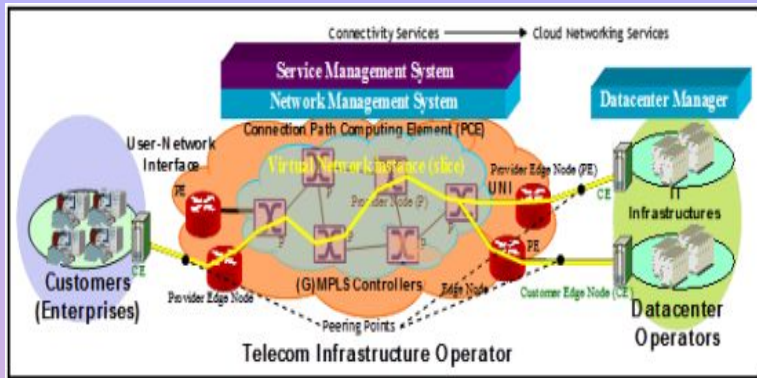
- Network and datacenter infrastructures
- Cloud service management : Virtual Private Network (VPN) services and Virtual Machine (VM) services

Cloud environments : main features

Dynamicity of the cloud

- "On demand" services to users : SaaS, PaaS, IaaS (distributed hardware and software resources)
- Varying resource volume and granularity :
    - Each application requires amount of ressources (data storage, processing capacity (CPU), network bandwidth), and vary over time (Elasticity)
    - Resource sharing : virtualization (degree of the virtualization), VM (Virtual Machine=CPU, RAM, disk capacity)
- Main features : efficient resource utilization, energy saving, scalability

Complexity of the cloud

- Performance analysis is difficult $\Rightarrow$ Dynamicity of the system
  - varying demand, system sizes, ressources (hardware, software, network)
  - different kinds of service applications (different QoS requirements)
- Clouds are complex system : size, behavior

Modelling clouds

- Goals : find accurate models for clouds
  - variable traffic demand, and resource demand
  - dynamic resource allocation :
    - consolidation (or Merge) of VM to fewer physical ressources (energy saving)
    - replication (or Split) of VM to more physical ressources
  - scheduling strategies
- Performance studies : with scalability of the request, with degree of virtualization,...

Modeling, analyzing, testing

- Define models for cloud environments (variable trafic, resource demand, resource virtualization (granularity), scheduling)
- Developping simulation methods : developping algorithms for large state space
- Comparing the mathematical results with :
  - simulators (Ex : CloudSim),
  - tests on plateforms (Ex : Cloud Red Hat, Globus Numbus)