

Auteurs

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Partenaires

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CONTEXT & MOTIVATION

BACKGROUND

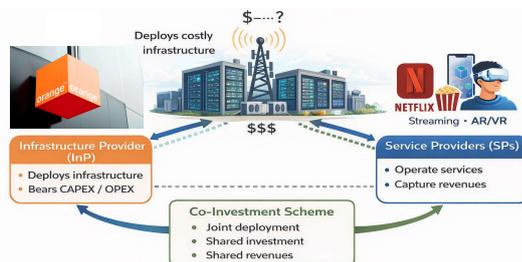
1. Deployment of digital infrastructure (e.g., Mobile Edge Computing) requires costly large-scale infrastructure.
2. A single actor cannot bear the cost alone.

ACTORS

Infrastructure (InP) and Service Providers (SPs).

ECONOMIC CHALLENGES

1. SPs capture revenues; InP bears cost.
2. Revenue–cost imbalance → infrastructure remains under-deployed.
3. Uncertain revenue and demand.
4. Unforeseeable opportunity costs over time, i.e., profit outside the investment project.



THESIS CONTRIBUTIONS

CO-INVESTMENT SCHEME

1. The InP and multiple SPs jointly deploy the infrastructure.
2. Shared investment cost and revenues.

COALITIONAL GAME FORMULATION

1. Model co-investment as a coalitional game.
2. Optimize infrastructure planning and resource allocation among SPs to maximize coalition payoff defined as: total service revenues – infrastructure cost.
3. Fairly distribute the payoff among InP & SPs.

PROBABILISTIC GUARANTEES

1. Stochastic modeling of revenues.
2. Derive lower bounds on the probabilities of coalition stability (no subgroup has incentive to deviate) and profitable co-investment (each player obtains non-negative payoff).

DYNAMIC MECHANISM

1. Infrastructure capacity can be updated.
2. Players may join, remain, or leave.
3. Entry fees, exit penalties, and compensations regulate participation.

RESULTS & INSIGHTS

PROBABILISTIC STABILITY

1. For 1 InP and 5 SPs (SP1–SP3 similar revenues, SP4 highest, SP5 lowest).
2. Show high stability when SP revenues are comparable.

Coalition size	0.001	0.25	0.5	0.75	1
{1,2,3,4,5}	1	0	0	0	0
{1,2,3,5}	1	0.21	0	0	0
{1,2,3,4}	1	1	1	1	1
{1,2,3}	1	1	1	1	1
{1,2}	1	1	1	1	1

PROBABILISTIC PROFITABILITY

1. Remains sufficiently high even under strong revenue variability.
2. Co-investment remains profitable even when stability becomes conservative.

Revenue variability	Profitability Lower bound
0.25	0.95
0.5	0.78
0.75	0.60
1.0	0.50

DYNAMIC MECHANISM IMPACT

1. Infrastructure updates increase profit under moderate opportunity costs.
2. Dynamic participation encourages broader coalition participation.
3. Dynamic participation increases profit under high opportunity costs.
4. Compensation sustains long-term cooperation.

