



# Cross-Monotonic in Cost Sharing Mechanisms Using Ns2

R. Ganesan<sup>1\*</sup>, Justin Joseph<sup>2</sup>, Jisha Isaac<sup>3</sup>

<sup>1,3</sup>Assistant Professor, <sup>2</sup>Associate Professor

<sup>1</sup>Veltech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai

<sup>2,3</sup> Cardinal Cleemis School of Management Studies, Trivandrum

\*Email: [ganeshtilect@gmail.com](mailto:ganeshtilect@gmail.com)

## Abstract

A cost-sharing plan is an arrangement of guidelines characterizing how to distribute the cost among adjusted clients. A cost-sharing strategy is check monotonic in case it satisfies the property that everyone is in a flawless circumstance when the course of action of individuals who get the affiliation creates. CM is a property that passes on a customer's part ought to be more humble when balanced in a more imperative set. CM is an key techniques to achieve the group strategy proofness. By using the multicast plans that objective the enhanced directing, cross-monotonic cost sharing, and stabilize budget. Unsurprising degree cost recuperations is conceivable, and also apply a primal-twofold diagram to in the meantime create an organizing strategy and a cost-sharing course of action, and demonstrate that the subsequent instrument is collect framework proof and ensures off base cost recuperation against a flawless coordinating game plan.

**Keywords:** Cross-monotonic, Game Theory, Linear Programming, group strategy proofness.

## 1. Introduction

Multicast models one-to-various data disseminating in correspondence frameworks, for instance, the spouting of live video to an immense social occasion of Internet customers. Standard multicast include configuration has been only point of view of multicast trees or frameworks that can be rotted into a game-plan of trees. An essential inspiration driving constraintment of the tree-based approach is that streamlining multicast execution and cost are identifying with the conjugative issues of Steiner tree (ST) pulverizing and littlest ST straightforwardly and are non-deterministic polynomial-time hardness. Another multicast credibility depiction is delivered by mishandling the encodable and furthermore replicable properties of information flowsa multicast evaluated is feasible in a planned framework if and just if its conceivable as a unicast to each gatherer freely. The vicinity of non-lovely practices shows another estimation of need into the

multicast issue, and effects consummate check to outline amazingly all the more troublesome. Utilizing cost sharing and exhausting plans, each immaculate multicast flow can be effectively executed, while keeping up goodness and spending balance.

The main objective of proposed system,

- Efficiency: maximize social welfare
- Budget Balance: cover the cost

### 1.1 Multicast routing

A multicast routing is used to share the data among multiple recipients. The goal of multicast routing is to find a links that connects to the entire node which have been attached to the multicast group. These applications include data transfer, continuous media streaming, data feeds, web crawling, interactive gaming etc., For example, uploading and downloading online videos and audios, teleconferencing etc.,

To an incredible degree accommodating thought is the possibility of a multicast: the sending of a package from one sender to various gatherers with a single send operation.

Multicast arranging is a strategy for transmitting a package from a lone source to various gatherers without misusing structure information transmission. To achieve transmission capacity, multicast planning builds up a guided tree that accessories the source to each and every one of the specialists and sends only a solitary copy of the bundle over every relationship of the masterminded tree. Right when a bundle achieves a branch point in the tree, it is reiterated and a duplicate is sent over each downstream affiliation together. Multicasting a great deal of data to far reaching social events of recipients are likely going to realize basic costs, and these costs ought to be secured by portions assembled from the beneficiaries. In any case, gatherers can't be charged more than what will pay, and the transmission costs of shared framework joins can't be attributed to any single recipient. In this way, one must arrangement cost-sharing instruments to

make sense of which customers get the transmission and the sum they are charged.

### 1.2 Multicast cost sharing

Cross-monotonic cost-sharing outlines that modify the money related stipend don't exist for multicast in remote systems. A CS arrangement is said to be CM if the cost offer of a center point does not increase, when the association set containing the inside point extends. In most sensible conditions, it meanwhile requires the cost sharing expect to be locked in and spending configuration adjusted. A CS strategy is inducing if no subset of focus fixations is charged more than the ideal cost of serving this subset alone. A cost sharing game plan is spending configuration adjusted it ought to recuperate the full cost of the game-plan.

### 1.3 Selfish agents

The issue rises up out of selfish multicast beneficiaries.

In the market of a multicast shape, parcels are assembled from flows or recipients and paid to joins. A multicast approach contains a flow coordinating game-plan and a cost sharing course of action that can be connected with any procedure of potential recipients. Cost shares assembled from beneficiaries are used to oversee flow costs at joins over the structure. Each customer has a (possibly great) valuation of the multicast advantage, referred to in a manner of speaking. The key test is to start beneficiaries to report their real valuations, for better picking whom to serve, and the sum to charge. A strategy confirmation instrument is one in which each customer's overarching system is to tell the truth that is lying won't give any benefit to have interest.

### 1.4 Cross monotonic multicast

In the directing and cost sharing of multicast towards a gathering of potential recipients, CM is a property that expresses a client's installment must be littler when adjusted in a bigger set. Being cross-monotonic has been appeared to be the key in accomplishing bunch strategy proofness. We contemplate multicast plans that objective ideal stream steering, cross-monotonic cost sharing, and spending balance. We demonstrate that no multicast plot can fulfill these three properties at the same time, and depend on in exact spending balance. We determine both positive what's more, negative outcomes that supplement each other for coordinated what's more, undirected systems.

To consider to balance strategy in cross monotonic. Some set  $S$  belongs to  $U(S \subseteq U)$ , an old job  $i$  and a new job  $j$  both added to  $S$  ( $i, j \in S$ ). the cost offer of  $S$  doesn't increment. On the off chance that  $i$  was little in  $S$ , at that point it stays little, and consequently  $i$ 's cost share stays  $p_i/m$ . On the off chance that  $i$  was substantial in  $S$  and turns out to be little in  $S \cup \{j\}$  at that point  $i$ 's cost share declines to  $p_i/m$ . It stays to demonstrate that the cost offer of  $S$  doesn't increment in the event that  $i$  remains substantial. Note that by including work  $j$ , the quantity of occupations whose preparing time is in any event  $t$  for some  $t \geq 0$  does not diminish.

### 1.5 Group-strategy proof

The ideas of cost-sharing will help and need to be generalized.

Properties of mechanism  
No positive transfers  
Voluntary participation  
Consumer sovereignty

Approximate budget balance

## 2. Related Work

An instance of undirected graph  $G = (V, E)$ , a non-negative costs functions

$c: E \rightarrow \mathbb{R}^+$  on the edges of  $G$ .

then  $k > 0$  a set  $R \subseteq V \times V$  of  $k$  terminal pairs.

Each pair  $(st_i, tp_j) \in R$  is associated with multiple customers or agents where  $1 \leq j \leq k$  is connection between nodes  $st$  and  $tp$  in the underlying network. A feasible solution is a forest  $F$  is a subset of all the Edges  $E$  and all the terminal pair are connect with the connection request  $(st_i, tp_j) \in R$ . it is an optimal algorithm to find smallest total cost..The Steiner tree problem in GRAPHS communicate cheapest possible, the root vertex  $r \in V$  for all terminal pairs  $(st_i, tp_j) \in R$ . the set of terminal  $R \subseteq V$  and root vertex  $r \in V$

For instance the wire directing stage in physical VLSI-configuration can be figured as a Steiner tree issue. For some, key agreeable cost sharing diversions, particularly when costs are super measured, it is realized that Moulin systems unavoidably experience the ill effects of poor spending balance factors. Mehta, Rough garden as of late presented non-cyclic instruments, which accomplish a marginally weaker thought of gathering strategy proofness, in any case, leave greater adaptability to enhance the estimate ensures regarding spending equalization and social cost

We utilize AKR to allude to this calculation. AKR is a primal-double calculation, that is, the calculation develops both an achievable and fundamental primal and a practical double answer for a straight programming plan of the Steiner woods issue and its double, separately.

A standard formulation Steiner-Forest problem has a binary variable  $X_e$  for all edges, if edge  $e$  has 1 means resulting in forest and 0 otherwise. But in strainers cut at least one terminal pair in  $R$ . Any attainable arrangement  $F$  for a given Steiner forest example must cross this cut at any rate once. i.e.,  $|\delta(U) \cap F| \geq 1$ .

A "progressive stay singular framework" shares costs incrementally as showed up by a settled asking for of the customers: the basic customer ceaselessly pays stay single cost, the second pays the stay lone cost of the essential two customers less that of the focal and so on. In case the second subordinates of costs are of an anticipated sign, such a framework yields an exceptional strong adjust at each profile of twisted slants in the beguilement where each customer picks his own specific demand. This comprehension, thusly, delineates a coalition technique affirmation social choice work [10].

A "sequential stand alone mechanism" shares costs highly based on the constant user order: The first user can independently pays the cost. Likewise, the second user can independently pay the first two users cost that is minus from first, it spread of consistent information from a source to different buddies inside a multihop remote framework, where peers are outfitted with uniform omnidirectional radio wires and have a settled cost for each package transmission. While various friends may be enthused about the dispersal advantage, their valuation or utility for such an organization is normally private information. An alluring coordinating and charging instrument underpins fair utility reports from the partners. We give both negative and positive results towards such instrument diagram. We exhibit that remembering the true objective to achieve the social event strategyproof property, an exchange off in coordinating optimality or spending design change is inevitable.

1. To answer the request whether enduring extent cost

2. 2 recovery is possible, we moreover apply a primal-twofold example to at the same time develop a coordinating game plan and a cost sharing arrangement, and exhibit that the consequent instrument is total strategyproof and guarantees cost recovery against a perfect directing arrangement.

An organization is made for a course of action of pros. The organization is matched, each master either gets advantage or not, and the total cost of organization is a sub specific limit of the set tolerating organization. Research to the framework confirm instruments that move particular availability to pay, pick who is served, and a while later offer the cost among them. If such a part is spending design balanced (deals with cost correctly), it can't be compelling (serve the surplus enlarging set of customers) and the a different way. Next depict the rich gathering of spending design balanced and collect method affirmation instruments and find that the segment related with the Shapley regard cost sharing condition is depicted by the property that its most perceptibly terrible welfare setback is irrelevant. Exactly when the required efficiency is rather than spending balance - the more common course in the written work that there is a singular Clarke-Groves instrument that satisfies certain sensible conditions: we call this the fringe cost assessing segment.

Cross-monotonicity is a key settling used as a piece of understanding the going with sort of segment design issues/games: consider the framework plot issue with a plan of intrigue centers  $D$ , with each customer (or demand)  $d$  having a related utility  $u_d$ . Since the customers have limited utilities, the master center needs to now pick which subset of customers it must serve, despite laying out the framework and picking how to share the cost between the served customers. A segment for handling this issue is called collect strategyproof if no subset of customers has a force to go not right from the tradition (e.g., by mutilating their utility) in the want of improving the outcome for themselves (e.g., tolerating the organization at a more affordable cost).

Moulin and Shenker [8] show that having a cross-monotone cost-sharing method for an issue regularly offers rise to a social affair framework confirmation part for the issue in the going with way. We start with each one of the customers; if there is some customer whose cost share (enrolled w.r.t. the present game plan of customers) outperforms its utility, we drop it from the set, recompute cost offers and repeat. Around the end, we are left with the pined for course of action of customers and their cost-shares.

To use a variety of this system to develop an around spending design balanced and hoard strategy proof cost-sharing procedure for the issue. The peculiarity of our approach originates from our getting the cost-sharing methods for the rent or-buy issue by means of decisively solidifying cost-shares for the less demanding Steiner tree issue. Our figuring is attentively less mind boggling than the past such cost-sharing strategy.

A cost-sharing arrangement is a course of action of principles which is used to share the organization cost (as often as possible handled by handling a combinatorial improvement issue) among customers. A cost-sharing game-plan is verify monotonic on the shot that it satisfies the property that everyone is in a faultless condition when the procedure of people who get the affiliation broadens. In this article, For exhibiting most noteworthy motivations behind constraint on the money related settlement change factor of cross-monotonic cost-sharing designs or the most basic condition level of recovered cost to demonstrate cost. Additional properties offer rising to cross-monotonic cost-sharing designs and hence our most noteworthy cutoff centers hold.

In the constrained theory of von Neumann and Morgenstern inconvenience in appraisal drives forward for the essential

preoccupations, and for simply those. In this paper a regard is finished up for the fundamental case and some of its simple properties are investigated. A course of action of three aphorisms, having essential regular interpretations, which do the secret to choose the regard especially fills in as a starting stage. Delight regards every now and again address data that can be evaluated in more than one satisfactory way (e.g., monetary entreties). they point out that in such a case a declaration about pleasant  $n$ -singular delight model might be "meaningless" as in its existence or lie depends upon the choice of a tasteful technique to check redirection regards. Particularly we separate clarifications about course of action thoughts, for instance, the inside, stable sets, the nucleolus, the Shapley regard (and its hypotheses).

The essential known general system for masterminding real, by and large spending course of action adjusted cost-sharing parts is an immediate aftereffect of Moulin. While Moulin portions have been reasonably expected for an expansive combination of jobs, late negative outcomes show that for a couple of, central cost-sharing issues, Moulin instruments unavoidably experience the detestable effects of poor spending configuration change, poor budgetary proficiency, or both. The non-cyclic instruments, another structure for outlining out genuine, for the most part spending course of action adjusted cost-sharing parts. Non-cyclic instruments thoroughly add up to up Moulin portions and offer three essential slants.

To begin with, it is less complex to layout non-cyclic frameworks than Moulin instruments: various set up primal-twofold computations typically prompt a non-Moulin non-cyclic part with awesome execution guarantees. Second, for a couple of fundamental classes of cost-sharing issues, non-cyclic frameworks have exponentially better spending arrangement modify and budgetary capability than Moulin segments. Finally, while Moulin segments have found application essentially in parallel demand beguilements, we extend non-cyclic frameworks to general demand redirections, a multi-parameter setting in which each bidder can be allotted one of a couple of levels of organization.

## 3. Proposed System

### 3.1 System Architecture

Cost-sharing gets ready for information dispersal in a remote uncommonly designated framework, when the major charging plan is required to be cluster methodology prove. In the meantime, the data movement methodology is required to use capable to the extent coordinating costs. A trademark data spread methodology that presents itself is multicast. The perfect multicast course ensures that there are no dull transmissions by any center point, thusly ensuring the total cost of remote transmissions is constrained. The arrangement of a primal-twofold based computation that guarantees a predictable spending design change extent when transmission costs are uniform. Another bearing is to consider the circumstance when beneficiaries to leave and merge the multicast session.

#### *Multicast Agent*

Multicasting is the process of providing service or common information from a designated source node to number of multicast receiver here call them as agents

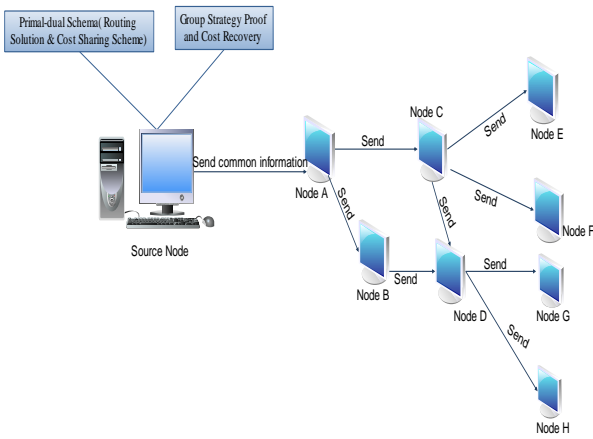


Fig. 3.1 Architecture Diagram

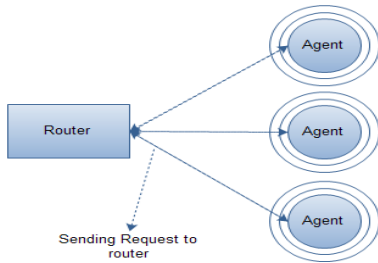


Fig.3.2 Multicast Agent

**Service**

Source provides the service to the routers and routers creates the number of copies of the service and send it to the receiver. This reduces the transmission cost as well as band with usage.

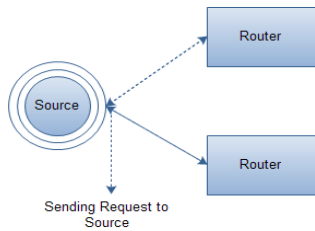


Fig. 3.3 Service

**New Member**

During this process consider that the new multicast receiver is added or new multicast receiver is willing to get the same service from the source node. Now the number of multicast receiver is increased

**Copy Creation**

When the new receiver is added to the multicast then the intermediate router has to create the number of copies of the service. Thus it prevents the high bandwidth usage and data replication.

**Budget Balanced**

A balanced spending design is when there is neither a spending inadequacy or a spending abundance – when earnings parallel utilize .

All the more generally, it suggests when there is no deficit, however maybe an overabundance. when revenues equal expenditure . More generally, it refers to when there is no deficit, but possibly a surplus.

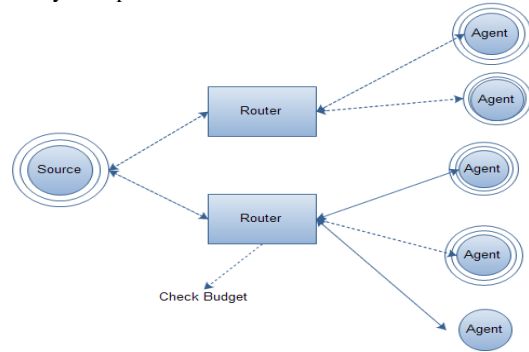
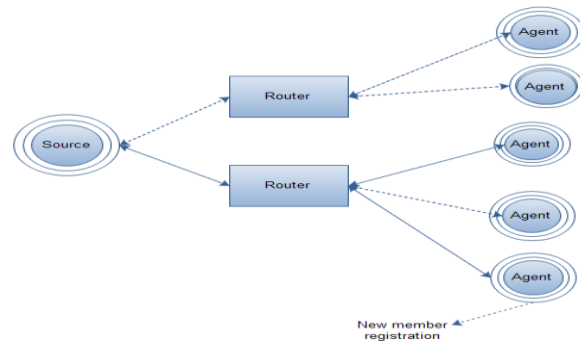


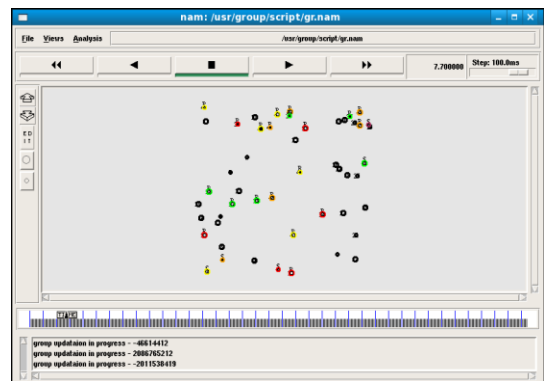
Fig.3.5 Copy Creation



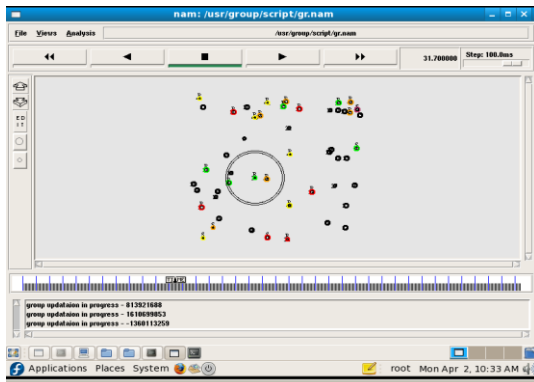
After the new customer is incorporated the cost sharing of a particular sub social affair may leads troublesome. Here the get-together strategy proves wind up clearly incapacitating. Directly by applying our balanced primal-twofold estimation forms cost shares that are cross-monotonic and around spending balance.

**5. Simulation Results**

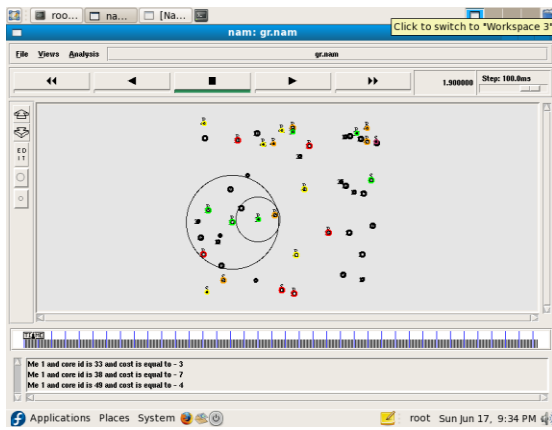
**5.1 Node Creation**



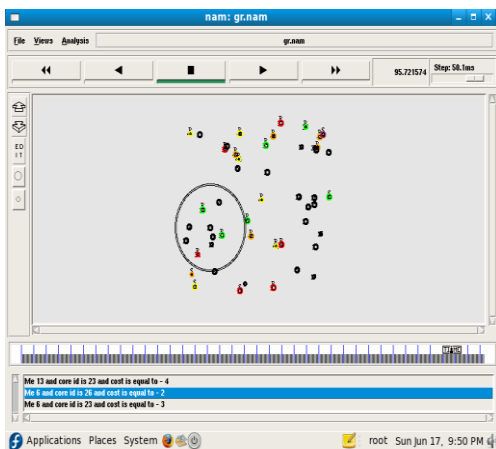
**5.2 Multicasting in a group**



### 5.3 Routing taking place in a node



### 5.4 Find optimal routing solution in a node



## References

- [1] Ahlswede.R, Cai.N, et.al., "Network Information Flow," IEEE Trans. Information Theory, vol. 46, no. 4, pp. 1204-121, 2000.
- [2] Brenner.J and Schafer.G (2009), "Cooperative Cost Sharing via Incremental Mechanisms," Preprint 650, DFG Research Center Matheon, Germany, 2009.
- [3] Goemans.M.X and Williamson.D.P "A General Approximation Technique for Constrained Forest Problems," Proc. ACM-SIAM Symp. Discrete Algorithms (SODA),2012.

- [4] Immorlica.N, Mahdian.M, andmirrokni.V.S (2005)," Limitations of Cross- Monotonic Cost Sharing Schemes,"Proc. ACM- SIAM Symp. Discrete Algorithms (SODA).
- [5] Jain.K and Vazirani.V,"Applications(2001) of Approximation Algorithms to Cooperative Games,"Proc ACM Symp.Theory of Computing(STOC)
- [6] Konemann.J, Leonardi.S,(2005)and G. Schafer, "A Group-Strategyproof Mechanism for Steiner Forests," Proc. ACM-SIAM Symp.Discrete Algorithms (SODA).
- [7] Li.Z,(2008),"Cross-Monotonic Multicast,"Proc.IEEE INFOCOM.
- [8] Mehta.A, Roughgarden.T, and Sundararajan.M(2009), "Beyond Moulin Mechanisms," Games and Economic Behavior, vol. 67,no. 1, pp. 125-155
- [9] Moulin,(1999) "Incremental Cost Sharing:Characterization by Coalition Strategy- Proofness",Social Choice and Welfare,vol.16,pp.279-320
- [10] Moulin, H. Soc Choice Welfare (1999) 16: 279. <https://doi.org/10.1007/s003550050145>
- [11] N. IMMORLICA, M. MAHDIAN, AND V. S. MIRROKNI, Limitations of crossmonotonic cost sharing schemes, in Proceedings of the Sixteenth Annual ACMSIAM Symposium on Discrete Algorithms, ACM Press, 2005, pp. 602–611.