



Gaming With COPS

A Content Centric Communication Infrastructure for Gaming Applications

Authors: Jiachen Chen, Mayutan Arumaithurai, Xiaoming Fu
(University of Goettingen, Germany),
K.K. Ramakrishnan
(AT&T Labs-Research, USA)

Presenter: Jiachen Chen

Outline

- Motivation
- Content-Oriented Publish/Subscribe
- Hierarchy Creation
- Hierarchical Publish/Subscribe
- Conclusion & Future Work
- Q&A

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Motivation

- Massively Multiplayer Online Role Play Gaming (MMORPG)
 - High interactivity
 - World of Warcraft
 - Counter Strike
 - Quake
 - Persistent view of the world
 - Second Life

Motivation

- Communication model:
 - Client-Server:
 - Server takes the responsibility for update dissemination
 - Limited server resources:
 - Interactive experience
 - Players that interact
 - P2P:
 - Peers store objects in DHT, query object state using gossip
 - Management overhead
 - Network overhead

J. Chen, "Gaming with COPS", EuroView 2011, Aug. 1-2, 2011.

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Motivation

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We need a communication infrastructure that is:

- Decentralized
- Aware of network topology

J. Chen, "Gaming with COPS", EuroView 2011, Aug. 1-2, 2011.

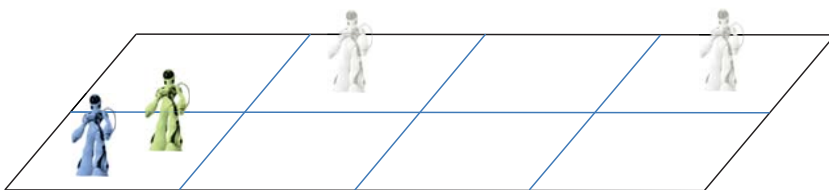
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Motivation

- Map partitioning
 - Quake [C/S]
 - Binary space partition
 - Second Life [C/S]
 - 7,000 servers simulating 16 acres each
 - Colyseus [P2P]
 - State partitioning & execution partitioning

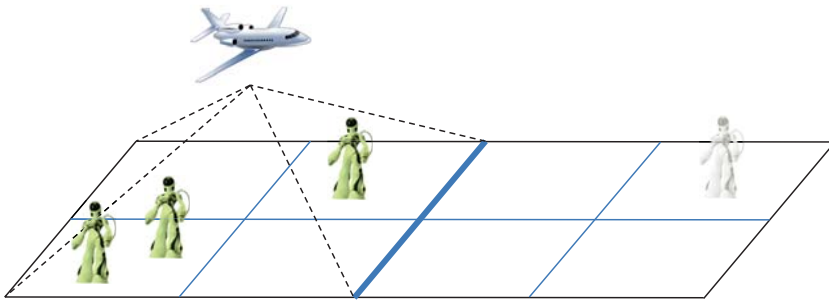
Motivation

- Map partitioning is good for update filtering:



Motivation

- But there are cases:
 - Size of vision might differ according to altitude

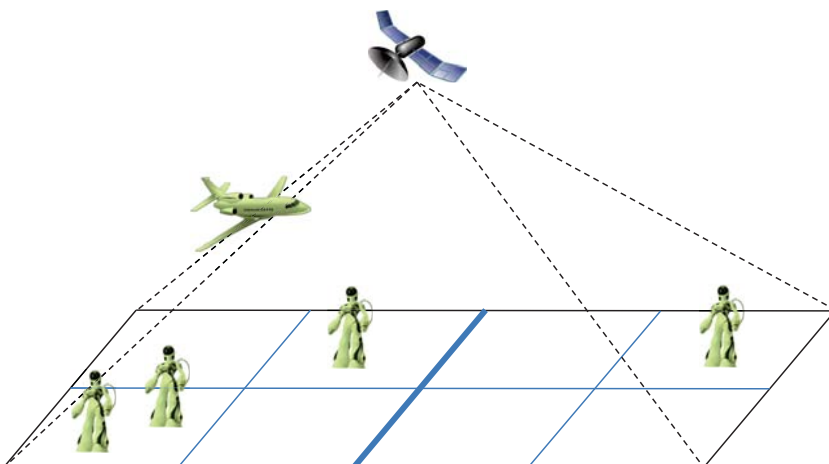


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Motivation

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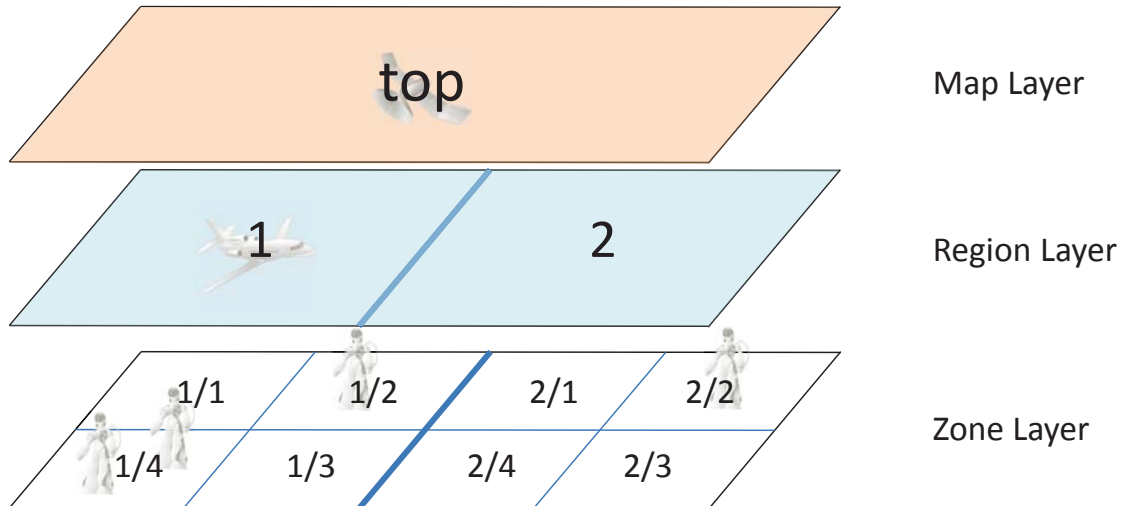


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Motivation

- Hierarchical map partitioning



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Motivation

- The communication infrastructure should be:
 - Decentralized
 - Topology aware
 - Support hierarchical map partitioning

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Motivation

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 - Decentralized
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 - Support hierarchical map partitioning

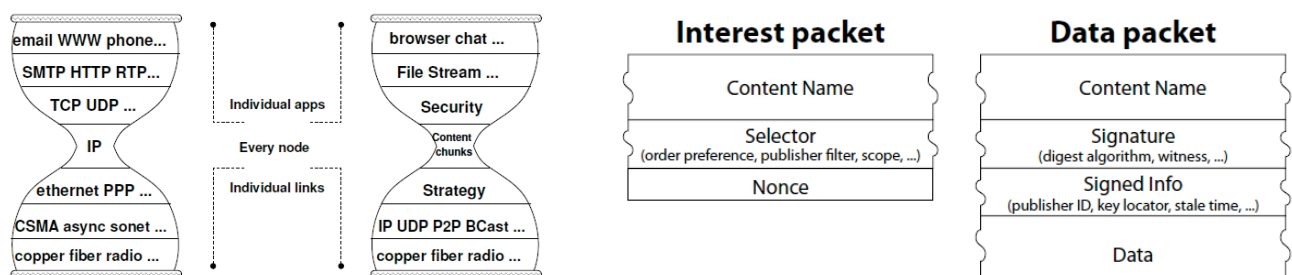
Gaming over COPS (GoCOPS)

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Content-Oriented Pub/Sub

- Content Centric Network (CCN/NDN)
 - *Host centric* → *Content Centric*
 - Hierarchical human-readable *ContentName*
 - E.g. /conf/papers/NDN.pdf
 - *Interest & Data* packets
 - Query/Response model

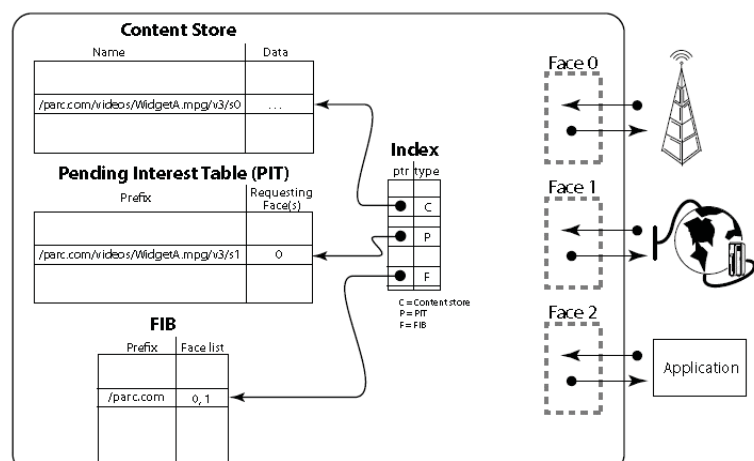


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Content-Oriented Pub/Sub

- Content Centric Network (CCN/NDN)
 - *Forwarding Engine*
 - *Forwarding Information Base (FIB)*
 - *Pending Interest Table (PIT)*
 - *Content Store*

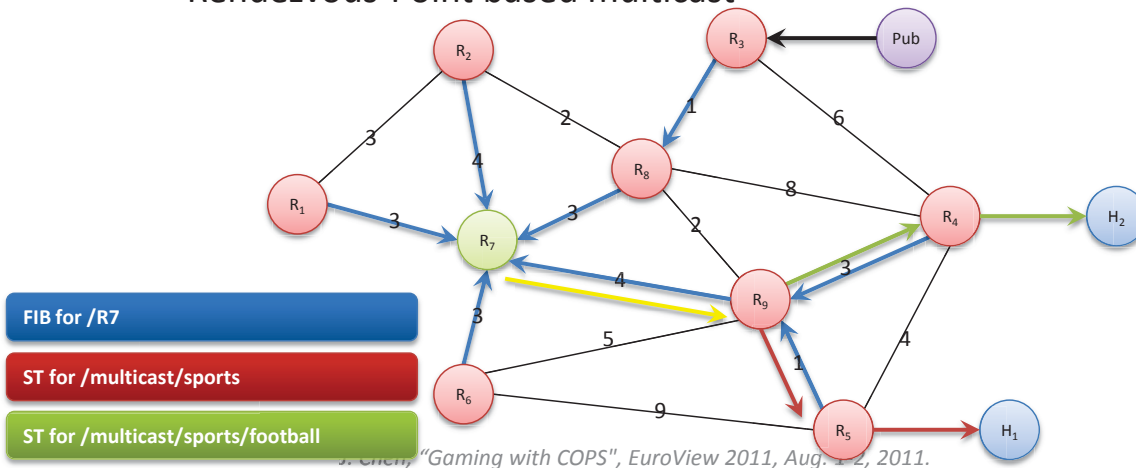


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Content-Oriented Pub/Sub

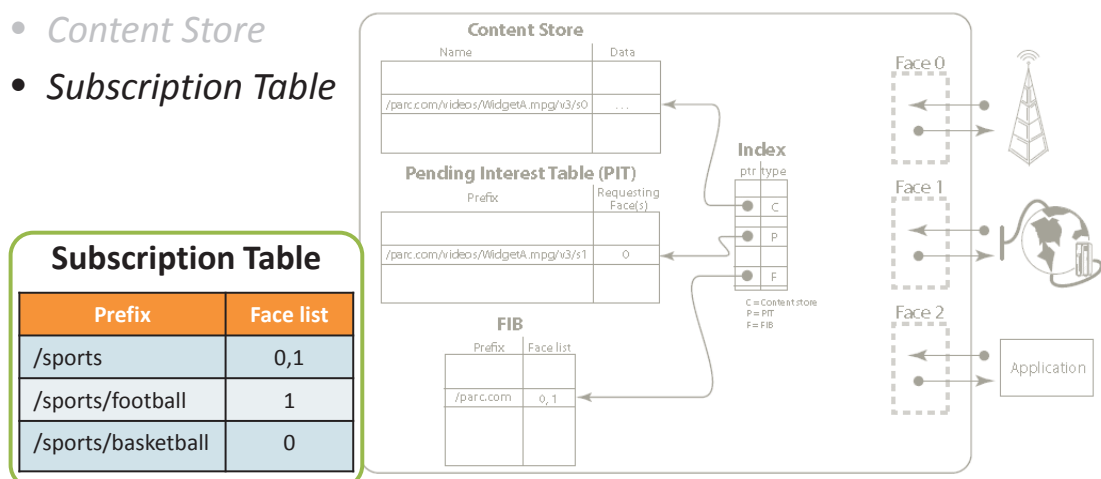
- Content-Oriented Pub/Sub (COPS)
 - Hierarchical Content Descriptor (CD)
 - E.g. /sports/football
 - Push based dissemination
 - Rendezvous-Point based multicast



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Content-Oriented Pub/Sub

- Content-Oriented Pub/Sub (COPS)
 - Forwarding Engine
 - Forwarding Information Base (FIB)
 - Pending Interest Table (PIT)
 - Content Store
 - Subscription Table



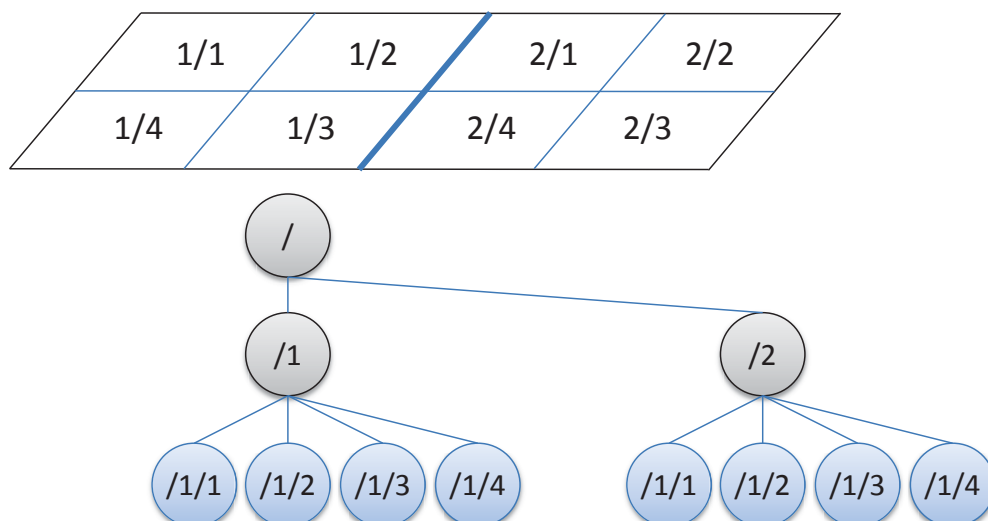
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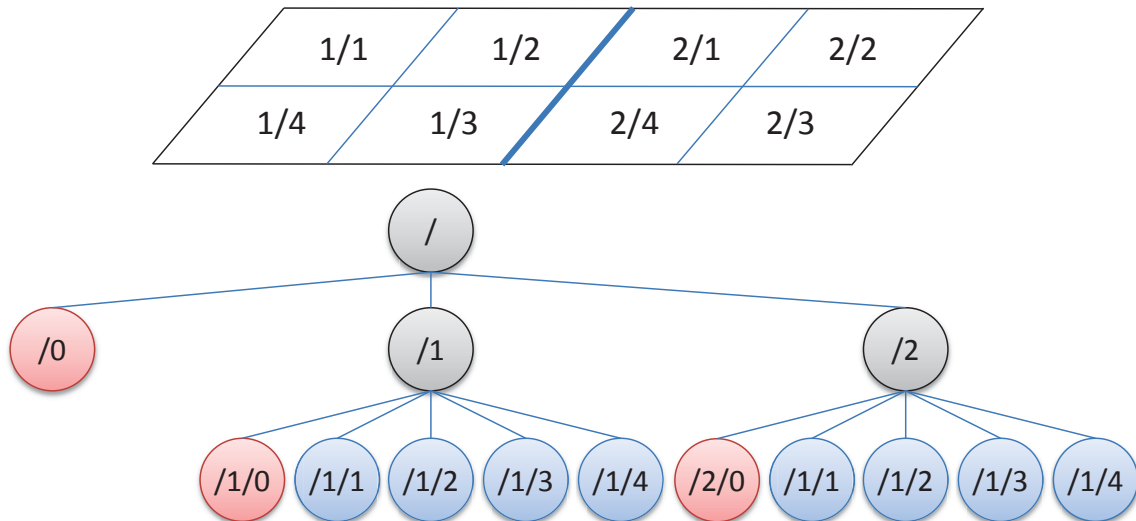
Hierarchy Creation

- Create a leaf CD for every zone



Hierarchy Creation

- Create a /0 for every non-leaf CD

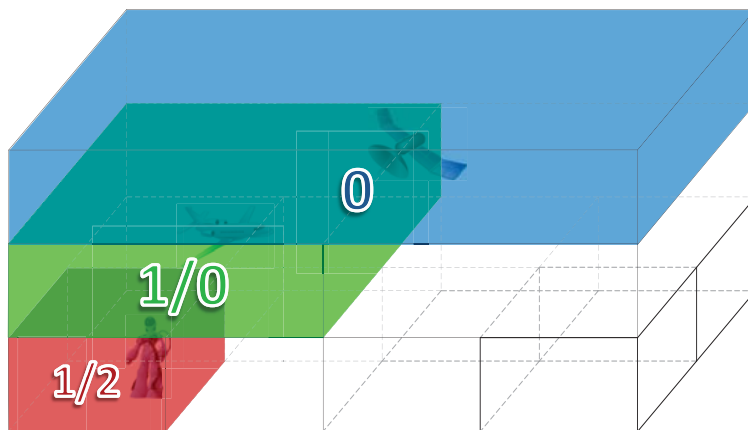


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Hierarchy Creation

- Create a /0 for every non-leaf CD



Satellite:



> Location: 0

Plane:



> Location: 1/0

Soldier:



> Location: 1/2

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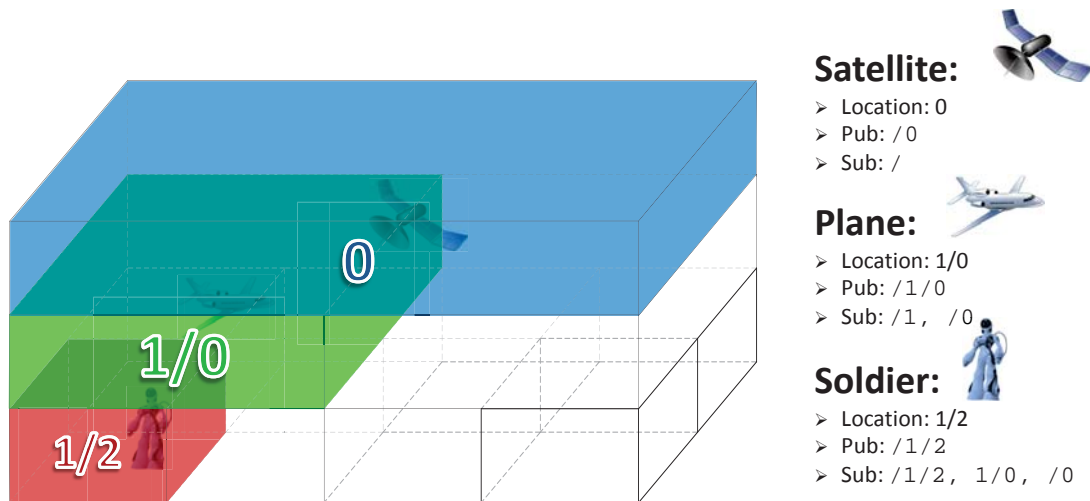
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Hierarchical Publish/Subscribe

- Publish
 - Leaf CD of the area the object is in
- Subscribe
 - Area he is in
 - All the / 0s along the hierarchy

Hierarchical Publish/Subscribe

- Example



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Conclusion

- GoCOPS: a communication infrastructure for gaming
 - Hierarchical map partition
 - Decentralized
 - Networking-layer

Future Work

- Networking layer:
 - Automatic Rendezvous-Point load balancing
- Application layer:
 - Player offline/move support
- Evaluation:
 - Compare content oriented GoCops vs. IP server/P2P based solutions

Any Questions?

Thank you!