Wireless Networks of Devices (WIND)

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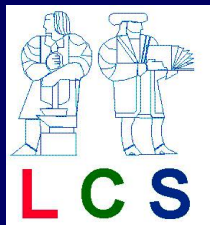
http://wind.lcs.mit.edu/

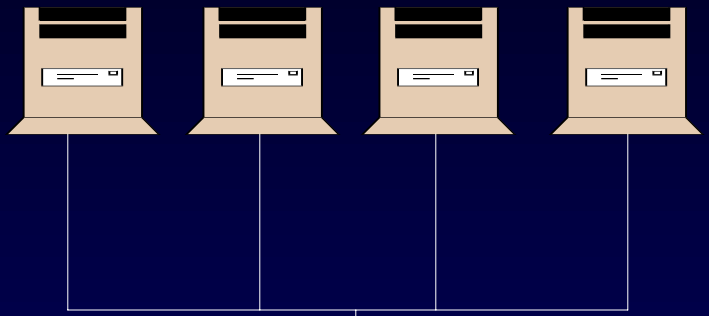
NTT-MIT Meeting, January 2000

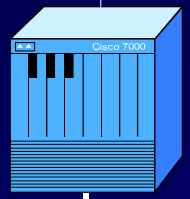


Motivation

Networks today

Clients





Routers

Web servers

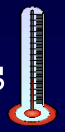
Future networks

Audio

Video

Devices

Sensors



Wireless

Mobile users

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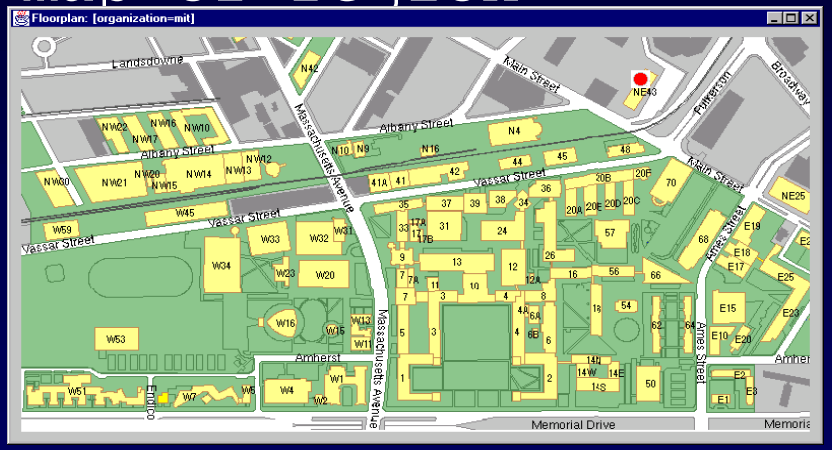
Location-based wireless servi

- Spontaneous networking
- Automatically obtain act
  map of region



- Communication & control
- Mobility & group
  communication

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WIND project

- Configuration
  - Topology formation in mobile networks
- Routing
  - Protocols for mobile devices
- Resource discovery
  - New naming system for ad hoc networks
- Adaptation
  - Congestion Manager for multimedia
- Security & privacy
  - Private location support system

Resource discovery

- Problem: advertise and locate resources and services
- Heterogeneous environment
  - Wide variety of devices, services, and information
- Dynamic environment
  - Mobile nodes and services
  - Variable, unpredictable performance
  - Device failures
  - Services composed of ungroof nodes

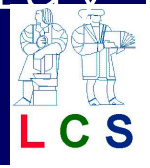
Solution: Intentional Naming System (INS)

Expressiveness → Names are intentional; know what, not where

Responsiveness → Integrate name resolution and message routing to handle mobility

Robustness → Decentralized, cooperating resolvers

Easy configuration → Name resolvers self-configure into overlay network



Naming and service discover

- Wide-area naming (DNS)
- Attribute-based systems (X.500)
- Brokers (CORBA, ANSA)
- Service location protocol (IETF)
- Device discovery
  - Jini, Universal plug-and-play
- Intentional Naming System (INS)
  - Mobility & dynamism via late binding
  - Decentralized, serverless operation
  - Easy configuration

Intentional names

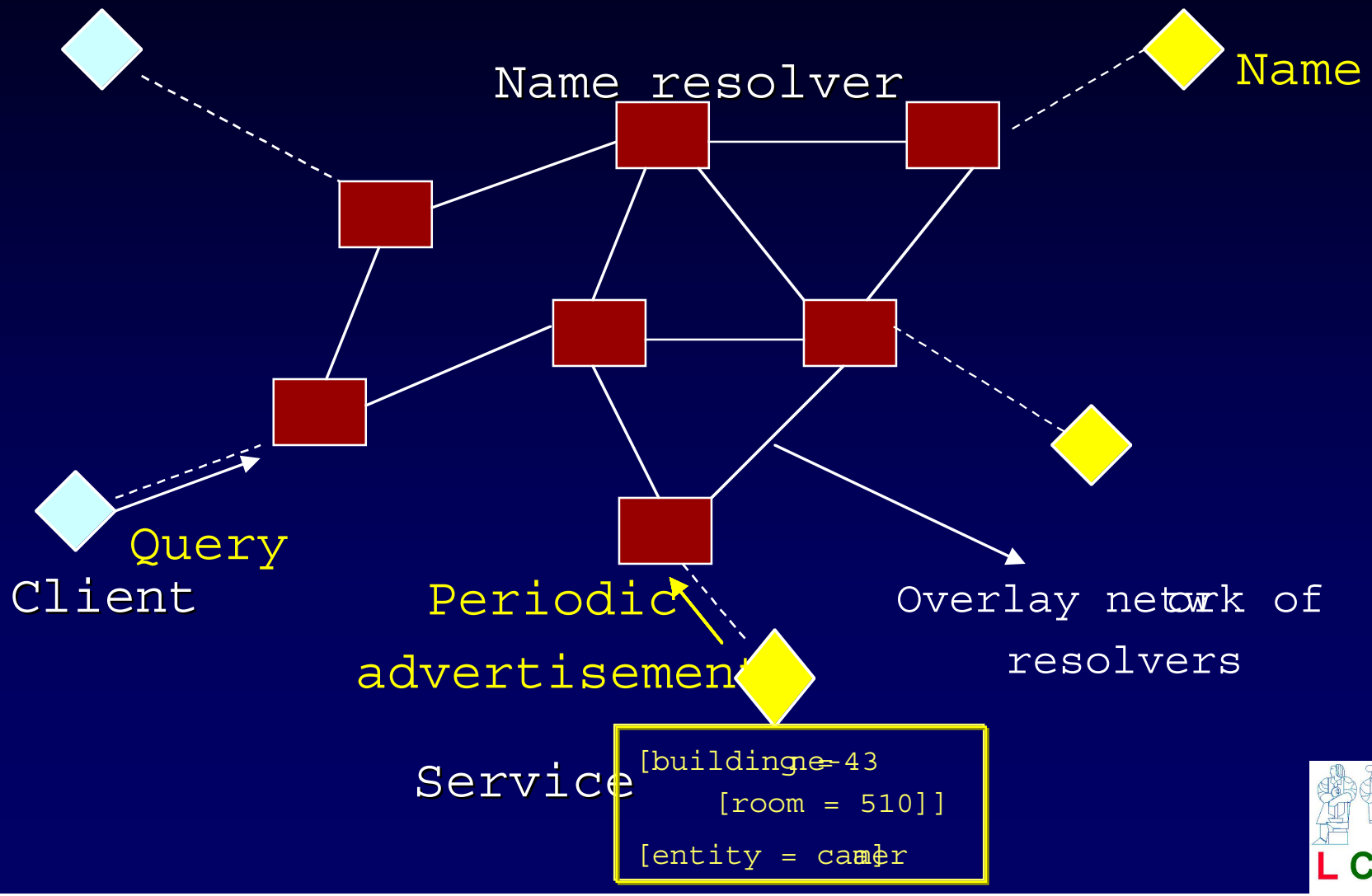
- Expressive name language (like XML)
- Providers announce descriptive names
- Clients make queries
  - Attribute-value matches
  - Wildcard matches
  - Ranges

```
[vspace = lcs.mit.edu/camera]
[building = ne43
   [room = 510]]
[resolution=800x600]
[access = public]
[status = ready]
```

```
[vspace = mit.edu/thermometer]
[building = ne43
    [floor5 =
      [room = *]]
[temperature < 60°F]
```

data

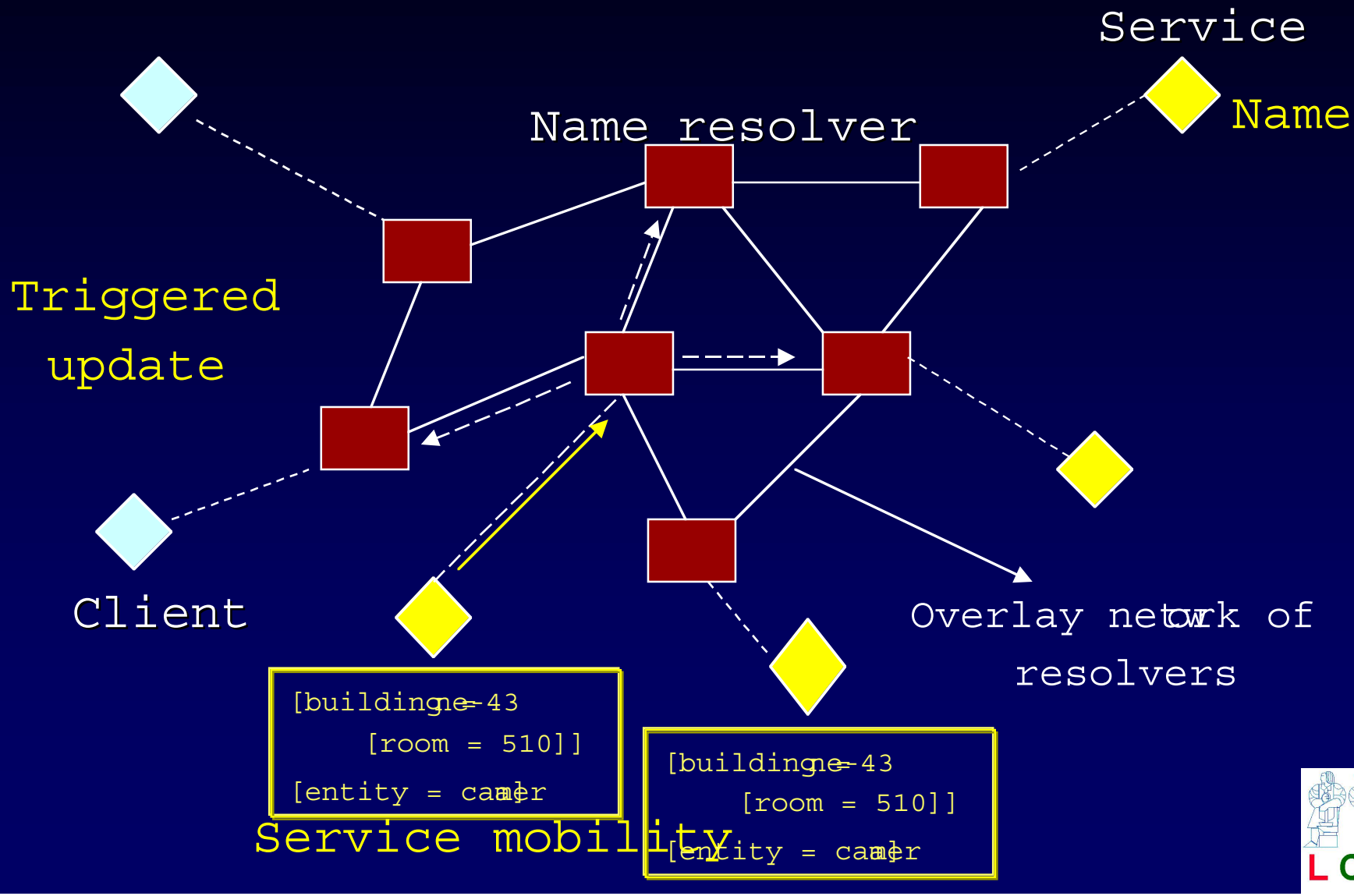
INS architecture



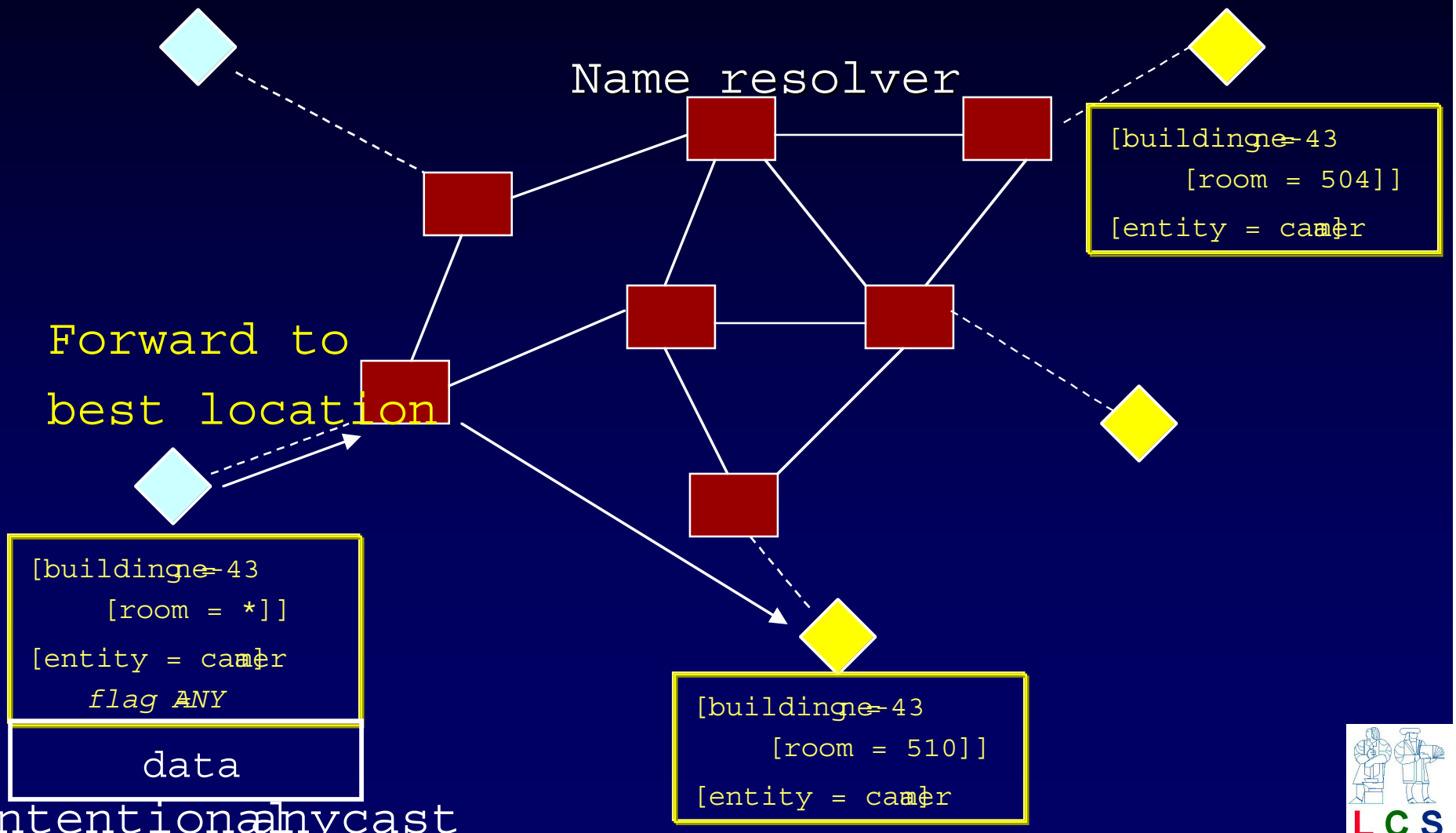
Name resolver functions

- Name lookup
- Routing protocol
- Handling service mobility
- Message forwarding
- Self-configuration algorithm

Routing protocol tracks chan



Late binding handles mobili



Intentional anycast

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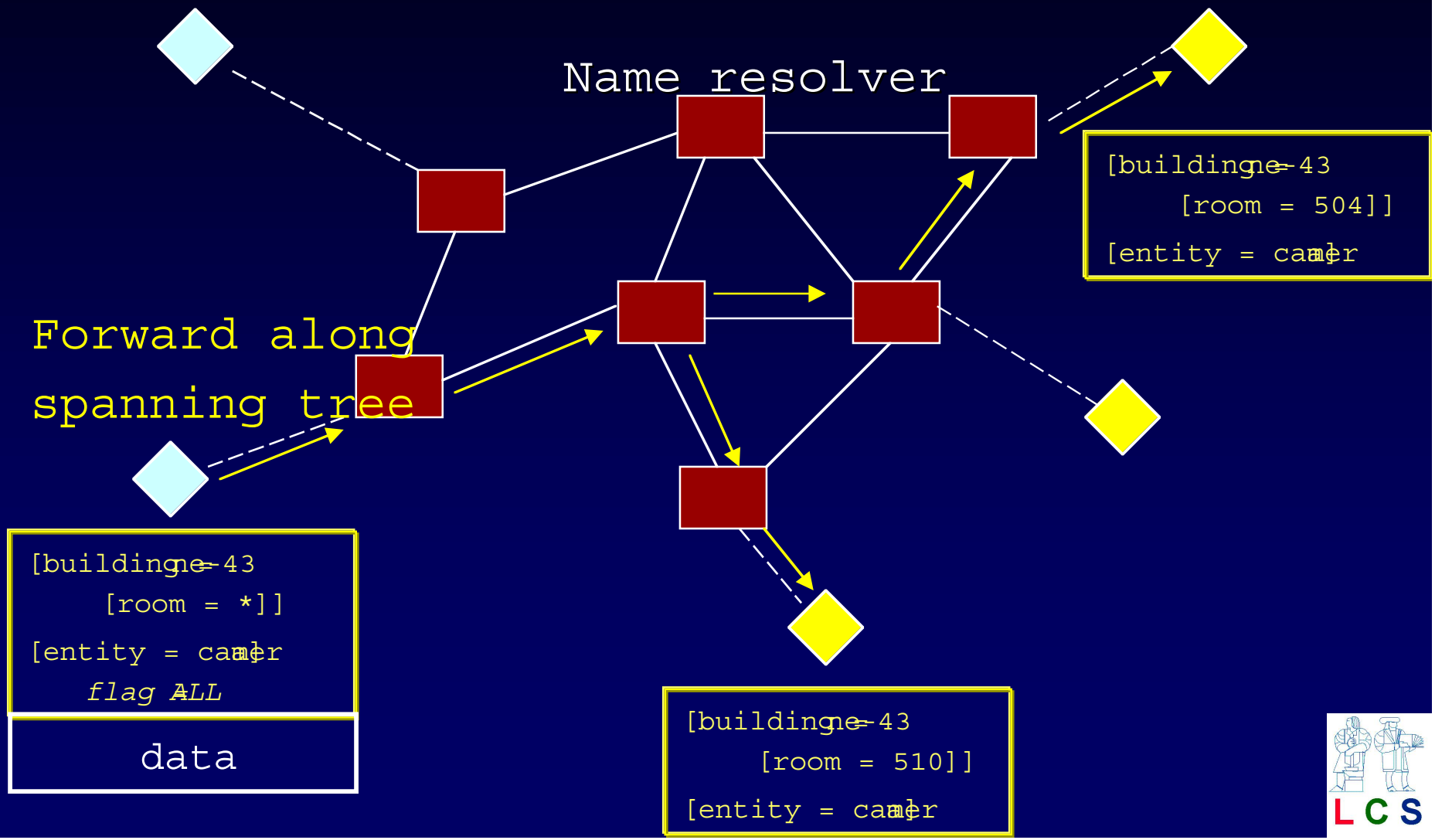
Intentional multicast for gr communication



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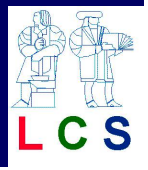
Two notable properties

- Robustness
  - Distributed cooperation without centralize servers
  - Routing information about names
  - Multicast forwarding
- Self-configuration
  - Resolvenetwork topology based on networ performance
  - Decentralized spanning tree algorithm



Status

- Java implementation of INS & applications
  - Active map, video delivery, jukebox, camera network node
  - Alpha code release for NTT
- Scalability & deployment
  - Wide-area architecture being designed
  - Standardization: MIME for devices (XML-based)

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Summary

- Future networks will include heterogeneous devi & services
  - Configuration, routing, discovery, adaptat security
- INS handles resource discovery in dynamic, mobile networks
  - Expressiveness: intentional names
  - Responsiveness: late binding
  - Robustness: decentralized resolvers
  - Configuration: self-configuration protocol

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