Designing for SCALP:
Small Contributions of Autonomic Large Populations

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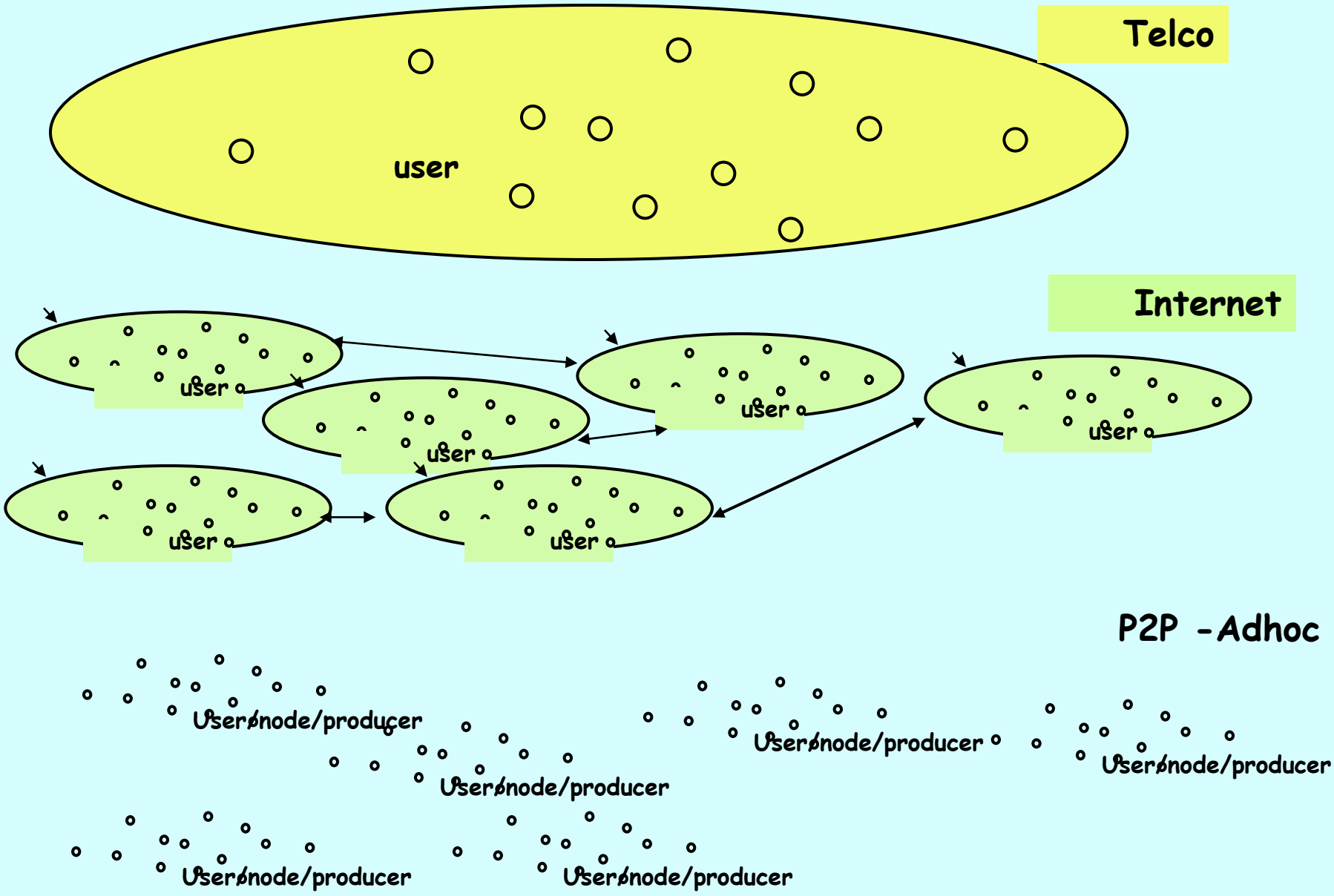
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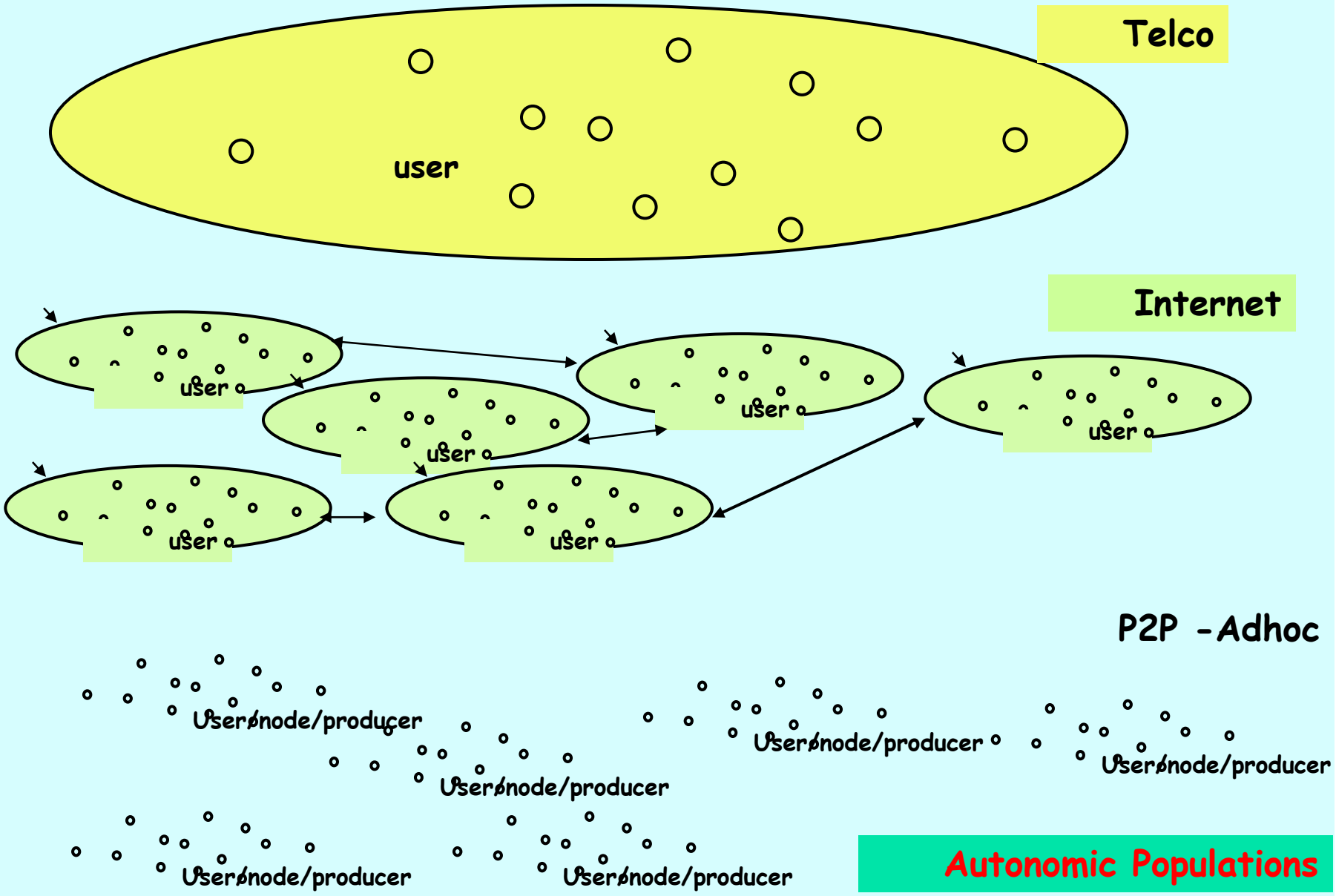
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Autonomic Populations

Large Autonomic Populations (1)

A necessity due to the unavoidable decentralization of …
… resources, ownership, etc

➔ Most networks of the future will form from ….
.... Small Contributions of Autonomic Large Populations (SCALP)

Designing for SCALP (1)

How to form networks via independently owned resource contributions?

Cooperation among selfish entities is central to forming such infrastructures and mistreatment should be absent.

How to cope with uncertainty of SCALP?

How can -redundancy- offered by large populations help cope with inherent uncertainty associated with autonomic behaviors?

Large Autonomic Populations (2)

A trend due to the decentralization of management

Autonomic Elements (AE) are designed to contain exploding complexity

➔ Networks of the future will be shaped by ….
.... Small Contributions of Autonomic Large Populations (SCALP)

Designing for SCALP (2)

Need to work on the science of interactions

Lots of other populations of

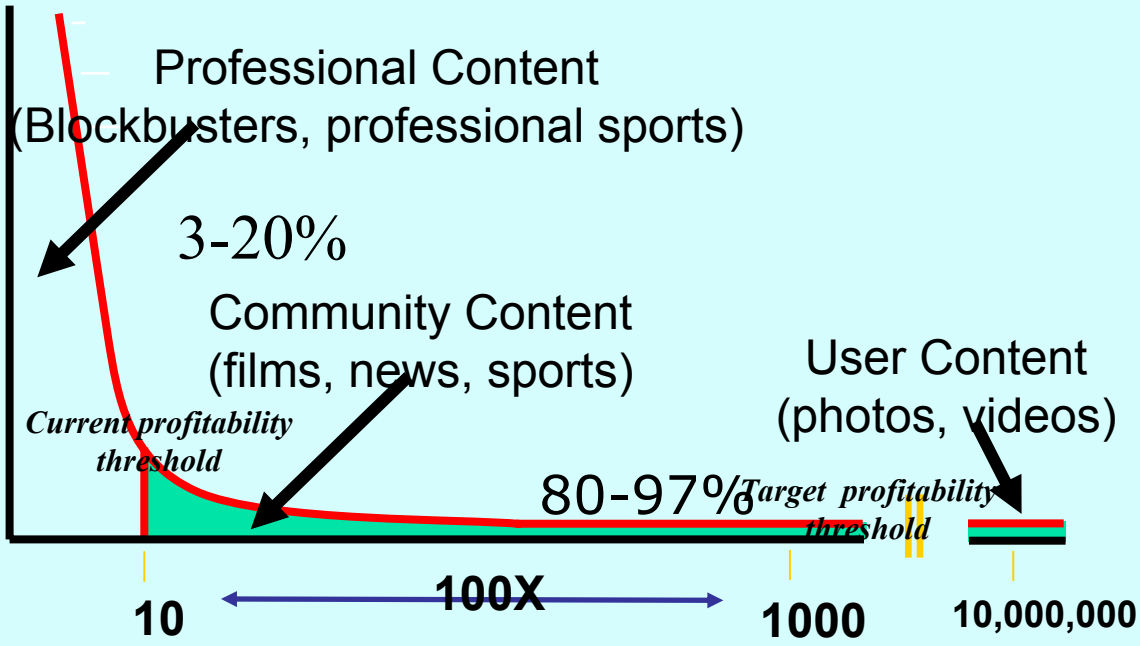
small Individual significance

but high Cumulative impact

seem to emerge

Large Autonomic Populations (3)

Explosion of user generated Content of low demand



PubSub paradigm will only intensify this trend!

Towards Content-centric Networking

Most network's work is already about delivering content

- Networks exist or are formed to deliver content
- Content is the destination
- Content management becomes important
- Content is miniaturized and explodes

Future networks would be content-centric

Designing for SCALP: Content-centric Networking

Most important job of users/nodes will be to produce /store content

(not to communicate with a destination or relay traffic)

Future Internet should facilitate:

- Distributed, autonomic storage management
- Autonomic content management

Autonomic storage management

Example: Distributed Selfish Replication

- **Design for cooperation gains without mistreatment (IEEE TPDS'06)**
- **Design under cooperation uncertainties**

Autonomic content management

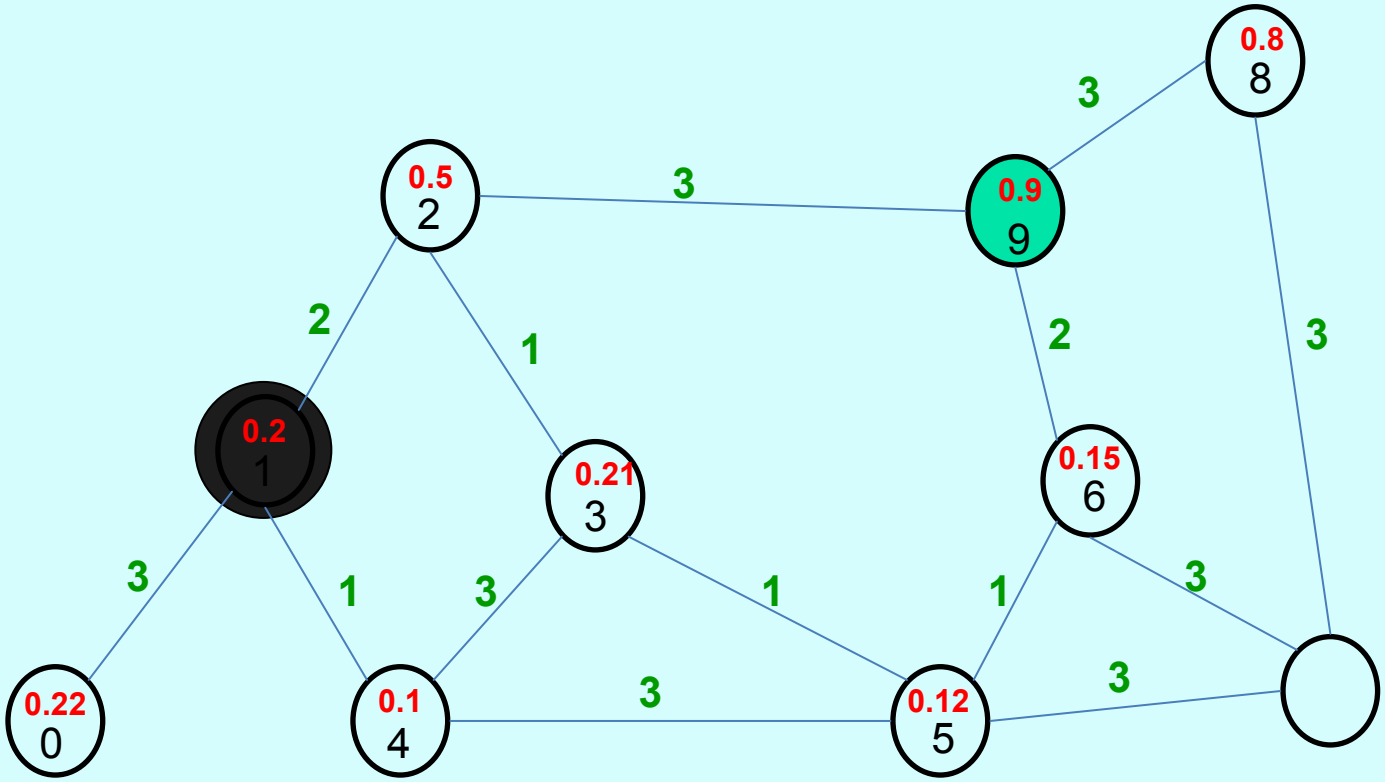
- **Let the content manage itself:**
  (keep the provision cost low and the profit high)
  - Decide how replicas to produce
  - Decide where each of these replicas should be stored.

- **Distributed Content placement / migration**
- **"Global" network outreach:**
  - **Scalable Content advertisement / discovery**

Autonomic content migration

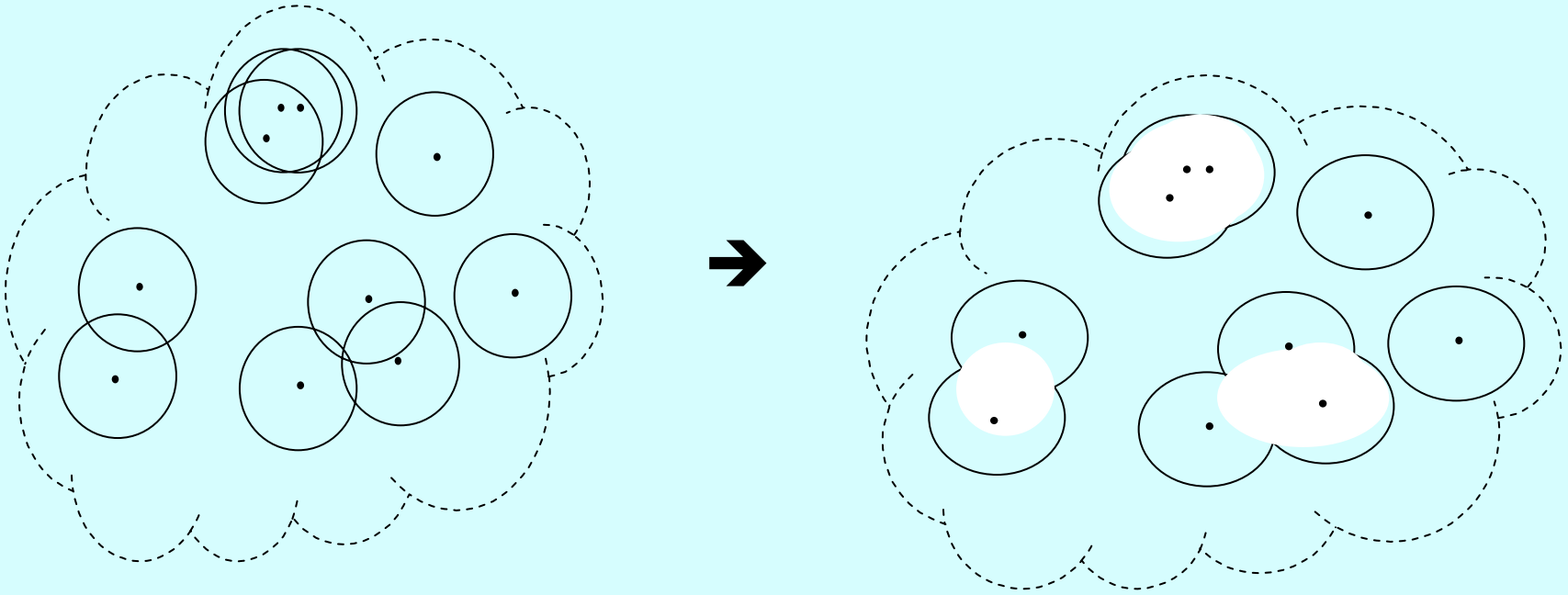
Large populations of content / large populations of potential hosts

Local topology and locally available demand information



Distributed Placement of Service Facilities in Large-Scale Networks (Infocom'07)

Facilities are put in the network at random initial locations and eventually they move towards the optimal position



Design for a wealth of means for info delivery and resources

- Sending, (BW – transmission resource)
- Storing, (caching, replication)
- Sensing, (data fusion / energy resource driven)
- Shipping, (carrying data)
- Stationing (info kiosks)

Can all help move the information around

<u>Accommodate mechanisms for resource exchanging</u>

On Demand Networking

Networks are being formed (resource pulling together occurs) in order to deliver a requested service:

- Pool of networking resources contributed or leased
  - Incentives, pricing, distributed management, etc

THANK YOU