Towards Secure Information Sharing Models for Community Cyber Security

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Secure Information Sharing (SIS)

- Share *but* protect

Saltzer-Schroeder[1] identified the desirability and difficulty of maintaining:
"some control over the user of the information even after it has been released"

[1]J. Saltzer and M. Schroeder. The protection of information in computer systems. *Proceedings of IEEE, 63(9):1278–1308, 1975.*

SIS Major Challenges

- Policy Challenge
  - Modeling, specifying and enforcing SIS policies
  - Need intuitive yet formal models, guaranteed security properties, etc.
- Containment Challenge
  - Ensure that protected information is accessible to users as permitted by the policy
  - Security mechanisms such as authentication, cryptography, trusted hardware, etc.

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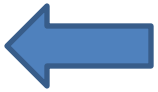
- Policy Challenge 
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Community Cyber Security

- Community refers to a geographical area
  - E.g. county or a city with demarcated boundary
- The Center for Infrastructure Assurance and Security at UTSA conducts nation-wide cyber security preparedness exercises and training
  - communication
  - incident response
  - disaster recovery
  - business continuity
  - security awareness, etc.

The Current Status…

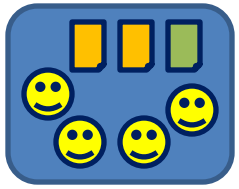
- Exchange of business cards
  - No process exists for information sharing
- Technology is not the bottleneck
  - Resistance due to political/competitive reasons
  - Also want to avoid embarrassment
    - E.g. by sharing attack data
- Participants have no clue as to *what* to share and *how* to effectively specify what to share

Requirements

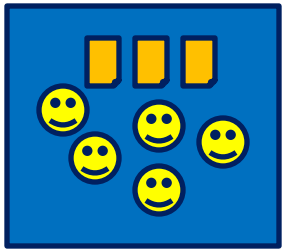
- Need abstract models
  - With rigorous mathematical foundations
  - Should ease administration
- Classic models are limited
  - Discretionary Access Control
    - Too low-level to configure
  - Lattice-Based Access Control (E.g. Bell LaPadula)
    - Rigid
    - One directional info flow is not the primary concern
  - Lot of work on Dynamic Coalitions
    - Many times heavy-weight
    - Mainly focus on technological/infrastructural integration

Life-Cycle of a Cyber Incident
Secure Sharing in a Community

Core Group



Open Group



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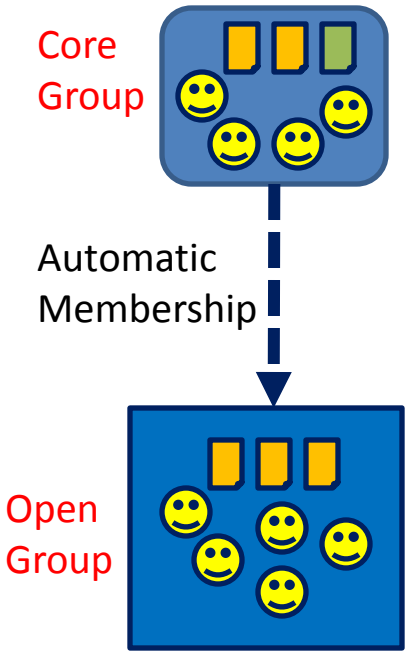

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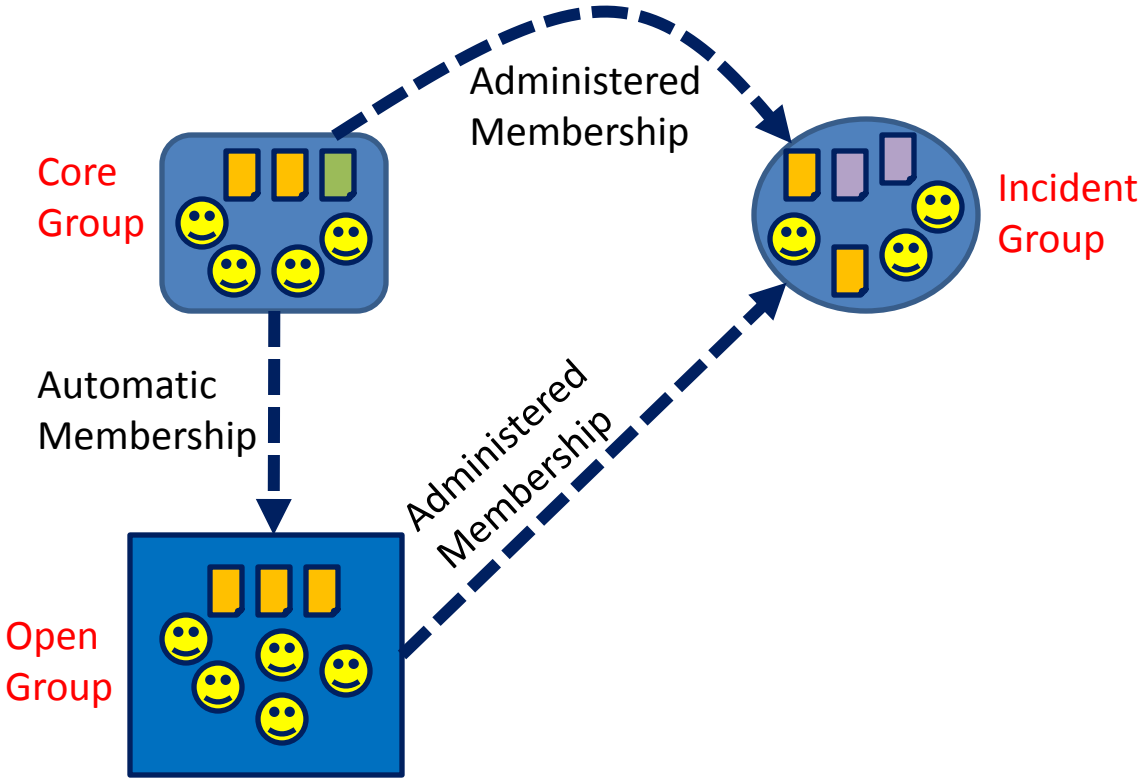

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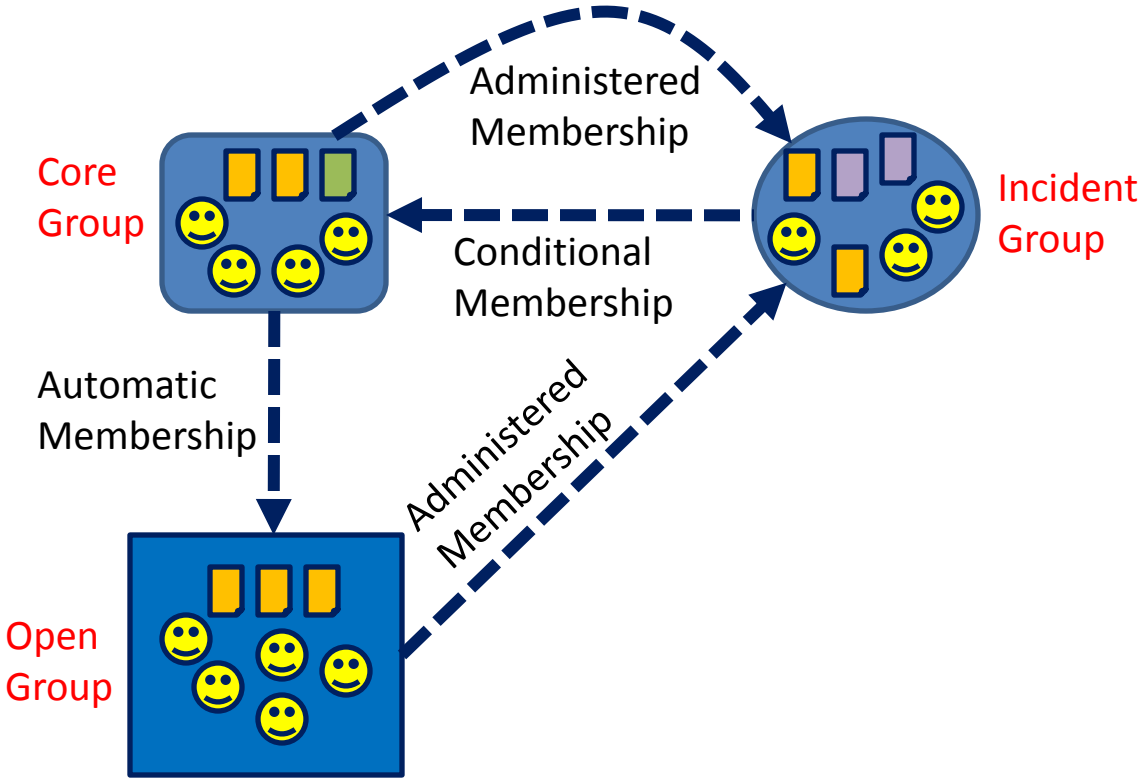

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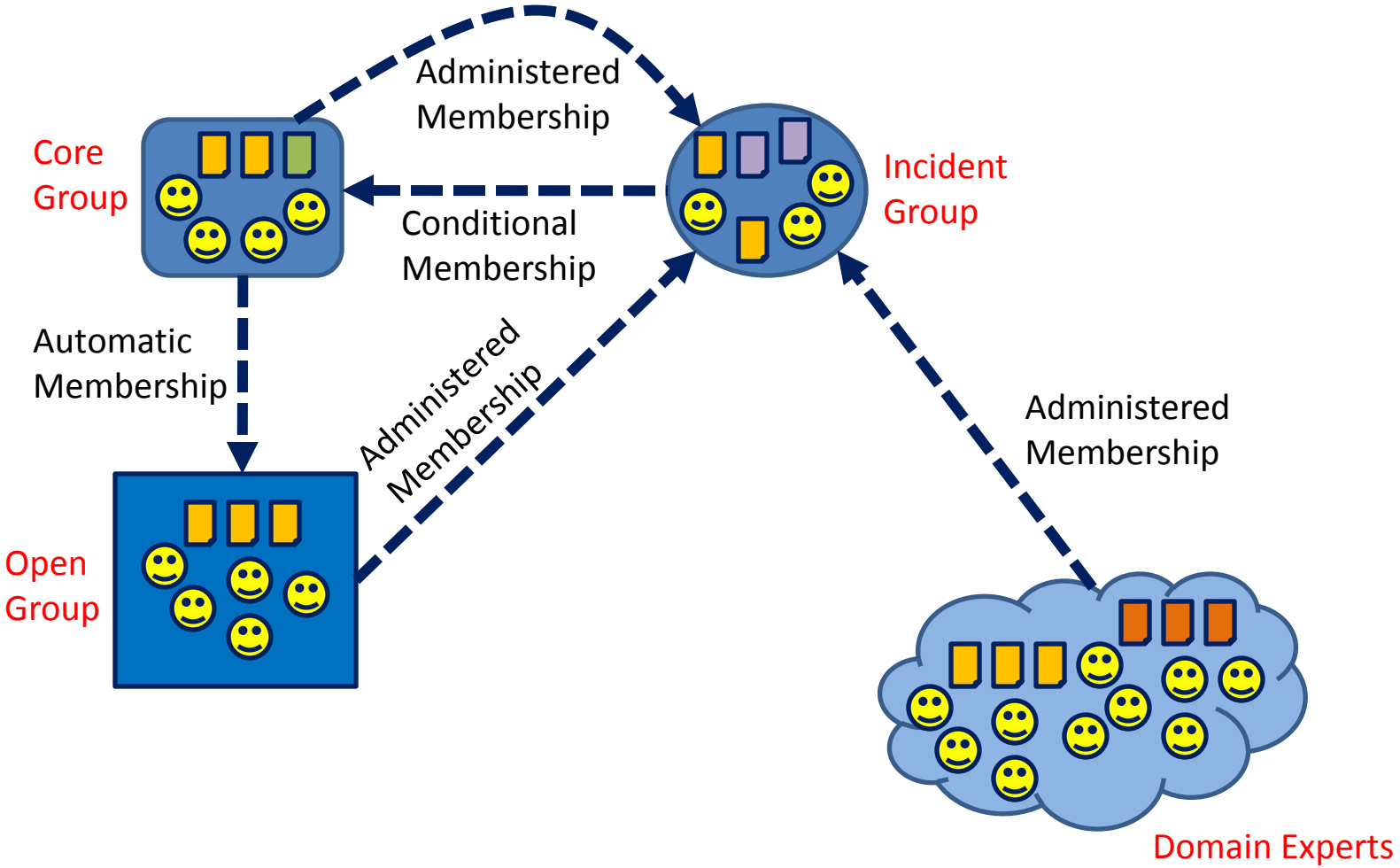

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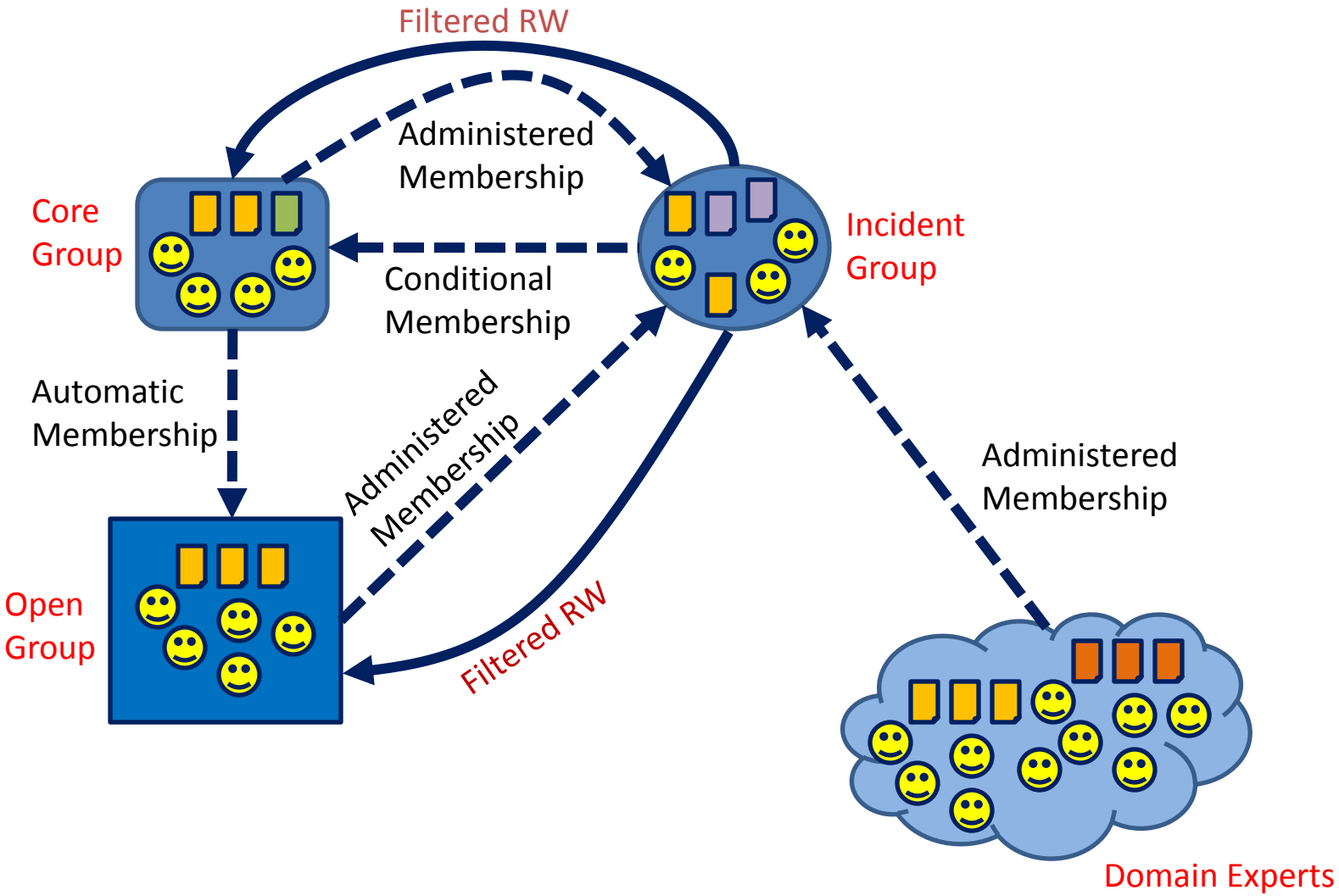
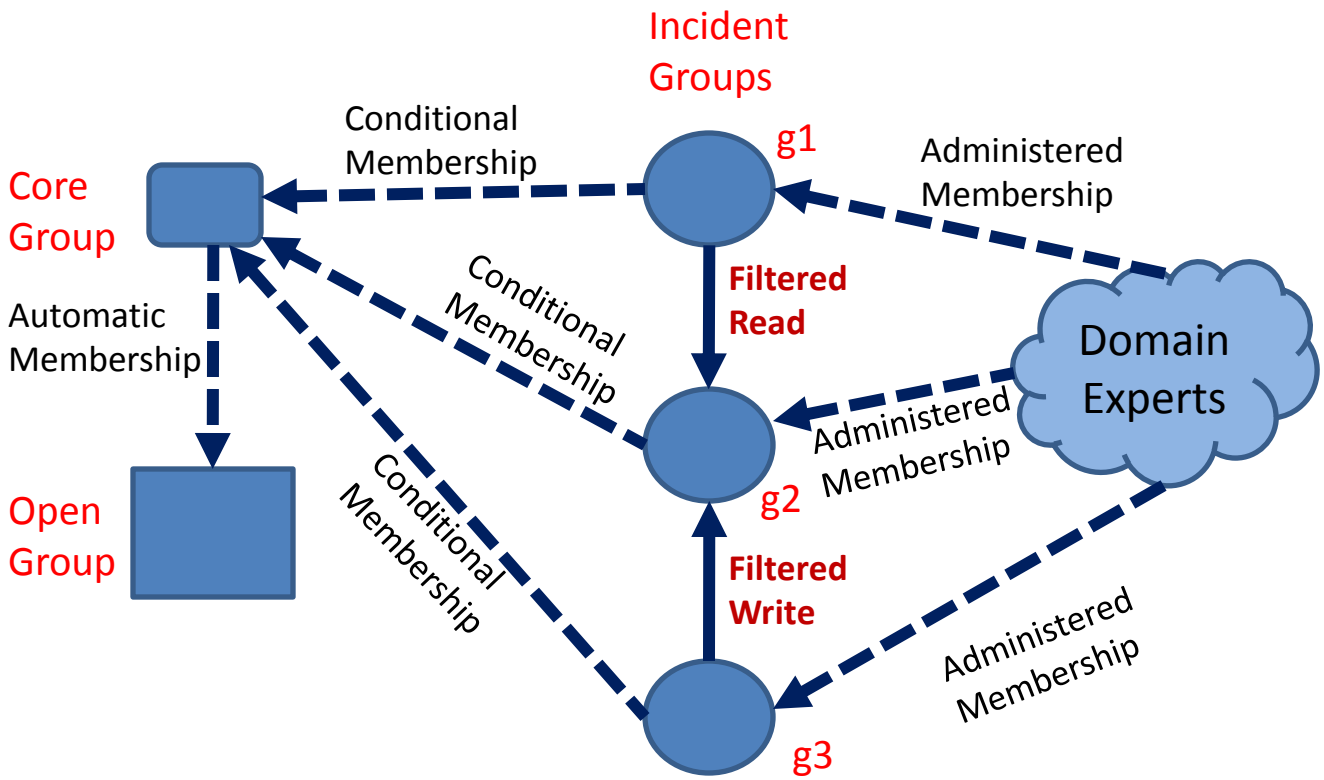
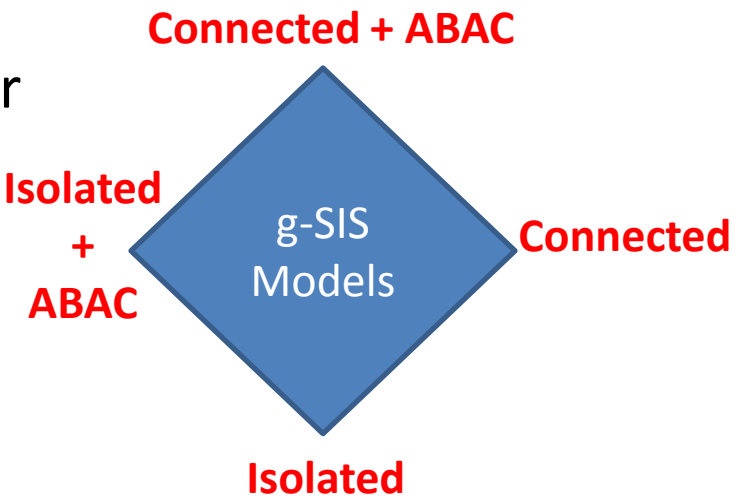


Life-Cycle of Cyber Incident Secure Sharing in Community (contd)



A Family of Group-Centric SIS Models

- Isolated
  - Users and objects are isolated
  - Membership in one group has no impact on authorizations in another group
- Connected
  - Membership in one group impacts authorization in another
  - E.g. Subordination, conditional membership, mutual exclusion, etc.
- Attribute-Based Access Control
  - For fine-grained authorization



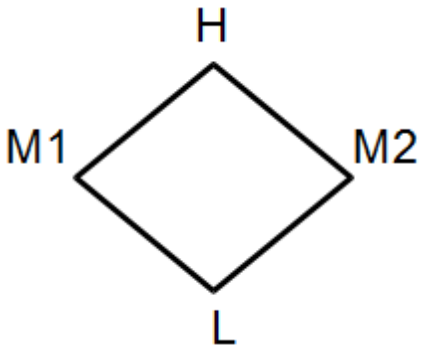
Conclusion

- SIS is still an open problem
- Technology is relatively under control
- Policy specification is key to SIS
  - Clear, usable and friendly policies can overcome political and competitive barriers to SIS
- One size does not fit all
  - Domain and application specific modeling and analysis is needed

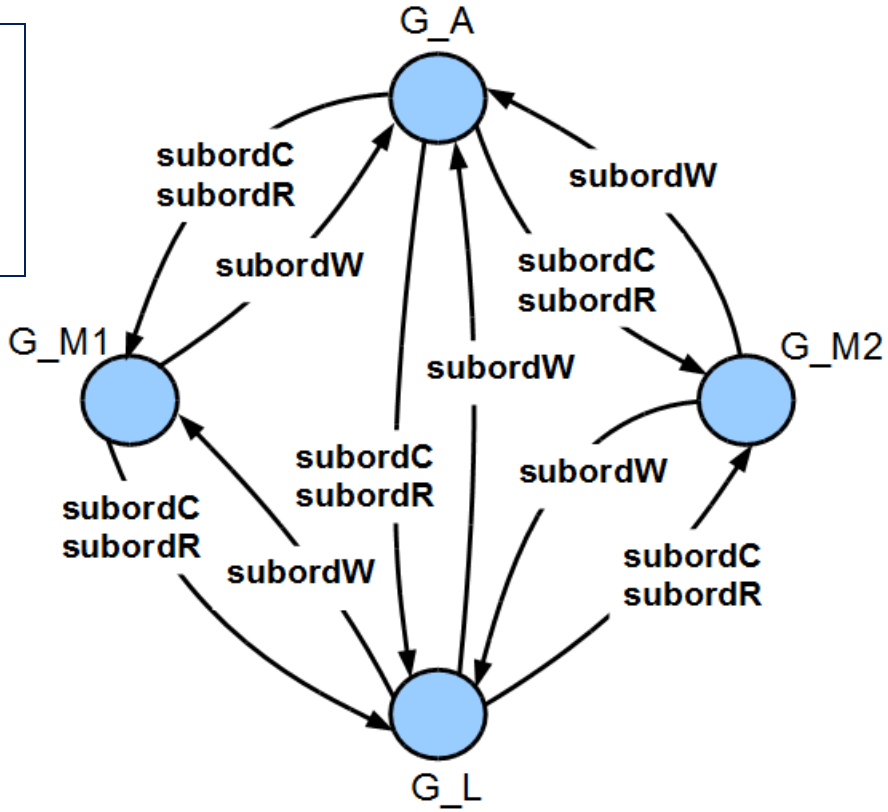
Backup

g-SIS and LBAC

1. Read Subordination
2. Write Subordination
3. Subject Create Subordination



A sample lattice for one directional information flow



Equivalent g-SIS configuration of Org A lattice

Agile Collaboration

1. Read Subordination
2. Write Subordination
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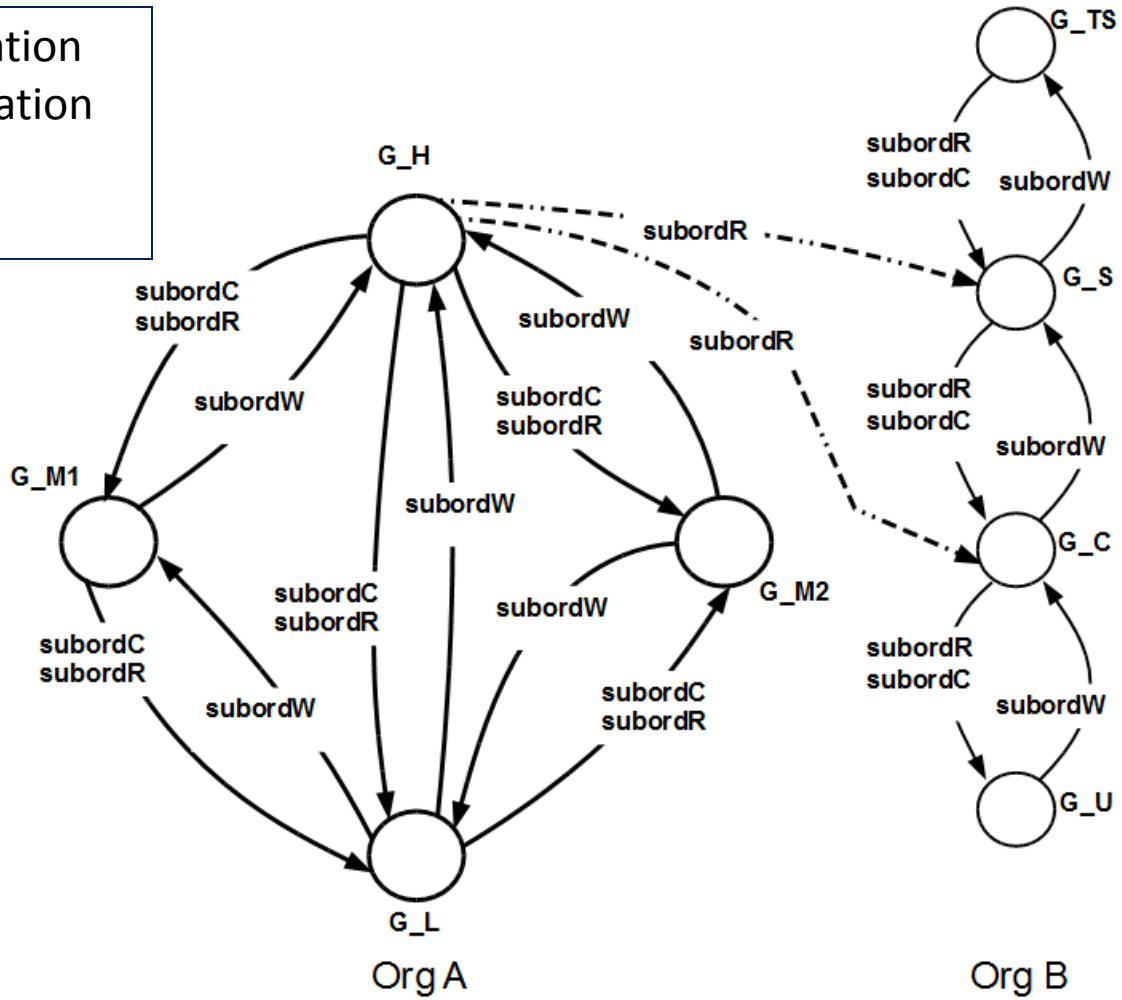
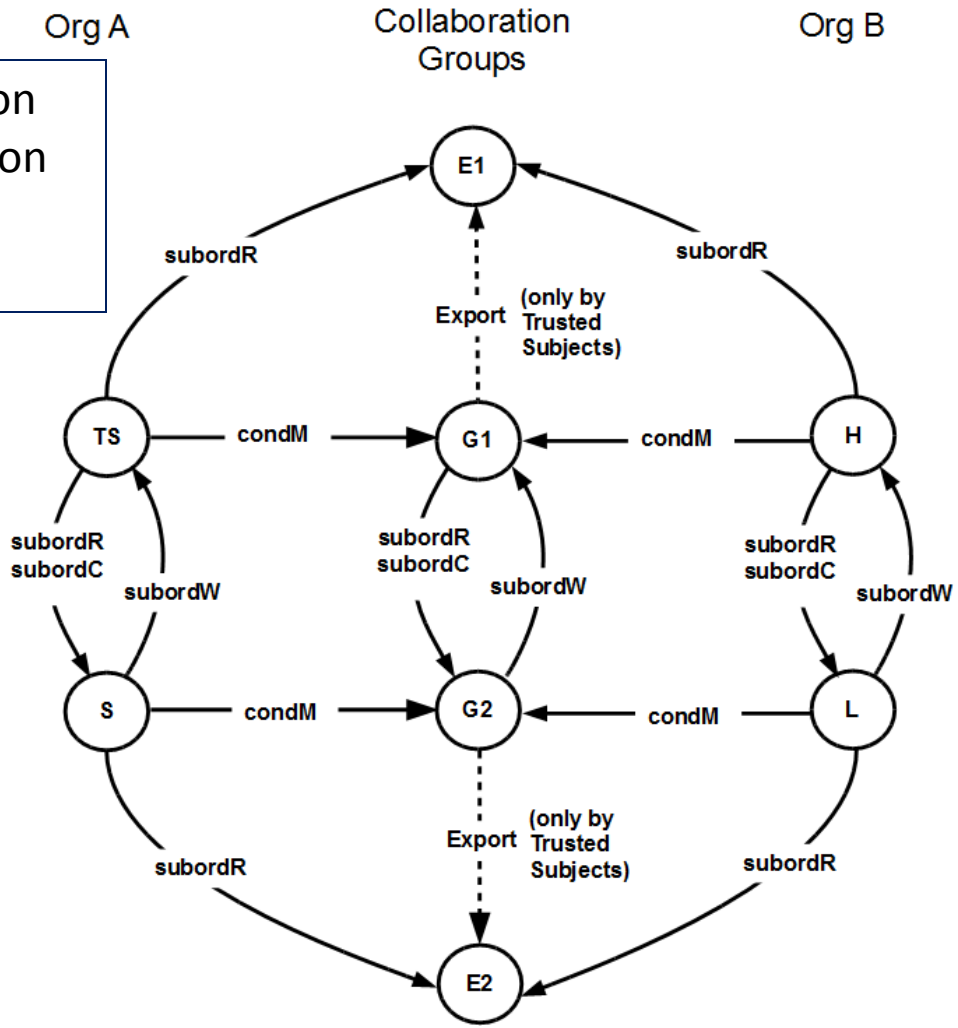


Agile collaboration in LBAC enabled by g-SIS

Agile Collaboration (continued)

1. Read Subordination
2. Write Subordination
3. Subject Create Subordination



Collaboration groups established between two different lattices

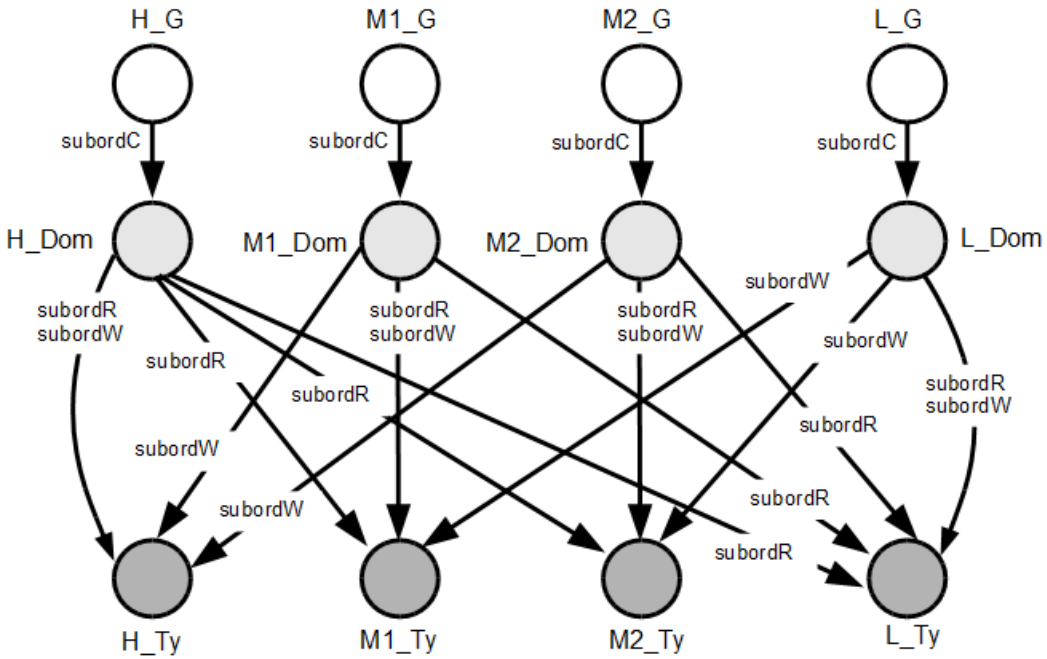
Domain and Type Enforcement and g-SIS

Objects

Subjects

Domain \ Type	H_Ty	M1_Ty	M2_Ty	L_Ty
H_Dom	*rw*	*r*	*r*	*r*
M1_Dom	*w*	*rw*	-	*r*
M2_Dom	*w*	-	*rw*	r
L_Dom	-	*w*	*w*	*rw*

A sample DTE matrix



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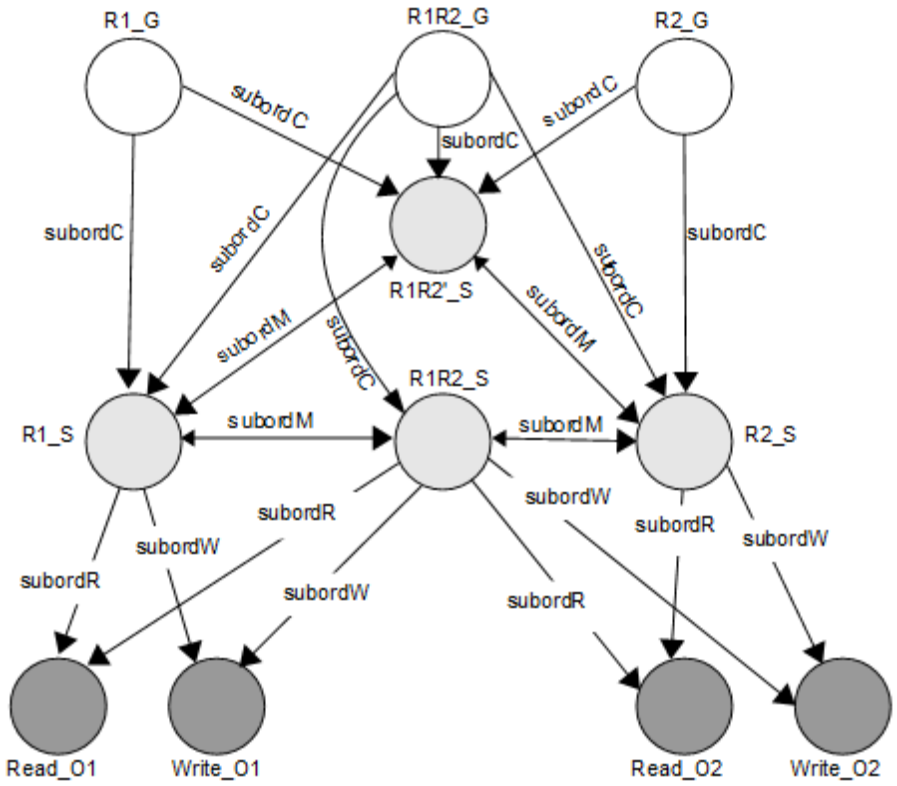
$RBAC_0$ and g-SIS



1. Read Subordination
2. Write Subordination
3. Subject Create Subordination
4. Subject Move Subordination

$RBAC_0$ with RW permissions in g-SIS