Multi-Institution Collaborative Computing: What Does it Really Take?

(http://www.esp.org/rjr/briite-RJR-salk-2005.pdf)

Robert J. Robbins

rrobbins@fhcrc.org

(206) 667 4778

Multi-Institution Collaborative Computing: What Does it Really Take?

(http://www.esp.org/rjr/briite-RJR-salk-2005.pdf)

Robert J. Robbins

rrobbins@fhcrc.org

(206) 667 4778

Multi-Institution Collaborative Computing:

What it REALLY takes is federated identity management, authentication, authorization, access-control, and auditing…

rrobbins@fhcrc.org

(206) 667 4778

Simple Fact

Biomedical research routinely spans institutional boundaries. Collaboration must be supported across these porous boundaries.

Simple Fact

Biomedical research routinely spans institutional boundaries. Collaboration must be supported across these porous boundaries.

Biomedical research requires secure computing environments. Good security requires a solid external perimeter.

© 2005, BRIITE

Simple Fact

Bi s
in n
m
po

Bi
co
se
perimeter.

ooops!

Contradictory Requirements

Simple Fact

Bi

i

r

p

E

c

s

perimeter.

Challenge:

We must support IT inter-operation and collaboration across multiple institutions while preserving and improving the security of our home institution.

Simple Fact

Bi

j

r

p

Problem:

Currently, no tools exist that provide an end-to-end solution to this challenge.

We must press on, regardless.

E

c

s

perimeter.

Simple Fact

Bi
in n
m
po

Bi
co
se
pe

The computer infrastructure to support multi-site collaborative research must often implement security in a manner that cannot (and should not) depend upon the enterprise security of any one institution. Nor can it depend upon the security system of any one virtual enterprise. An ideal security system for this environment would be a totally decentralized, federated approach that provides open protocol-based components to allow the creation of and participation in numerous, independent virtual enterprises.

Topics

- Background
- Totally Decentralized Federation is Essential
- Federation is Different (& Hard)
- All Components, All the Time
- Making it work
  - Logical Simplicity
  - Social Scalability

Topics

- The Problem
- A (Possible) Solution:
  - GlAAAAS
  - GlAAAAS in Action
- Reality Check:
  - What’s Really Possible
  - What Should be Done

Background

General Items

FHCRC

- Independent biomedical research organization
- 2500 employees
- Many relationships with other organizations
- Researchers collaborate outside our organization
- Much diversity within the organization
  - Four research divisions
  - Multiple research programs
  - 35 IT departments

RJR – Full Disclosure

- VP/IT at FHCRC
- PhD biologist
- Experience in community information infrastructure
  - NSF: first bio program officer for database activities
  - GDB: director, informatics core
  - DOE: genome program information infrastructure
  - caBIG: strategic & architectural planning

RJR – Full Disclosure

- BIASES
  - Database bigot
  - Even bigger TCP/IP bigot
  - Believer in decentralized components

RJR – Full Disclosure

- BIASES
  - Database bigot
  - Even bigger TCP/IP bigot
  - Believer in decentralized components
- Personal Observation
  - No big IT failure has ever occurred because of too much design and not enough execution

RJR – Full Disclosure

- BIASES
  - Database bigot

But isn't a BIAS FOR ACTION a good thing?

of too much design and not enough execution

RJR – Full Disclosure

- BIASES
  - Database bigot

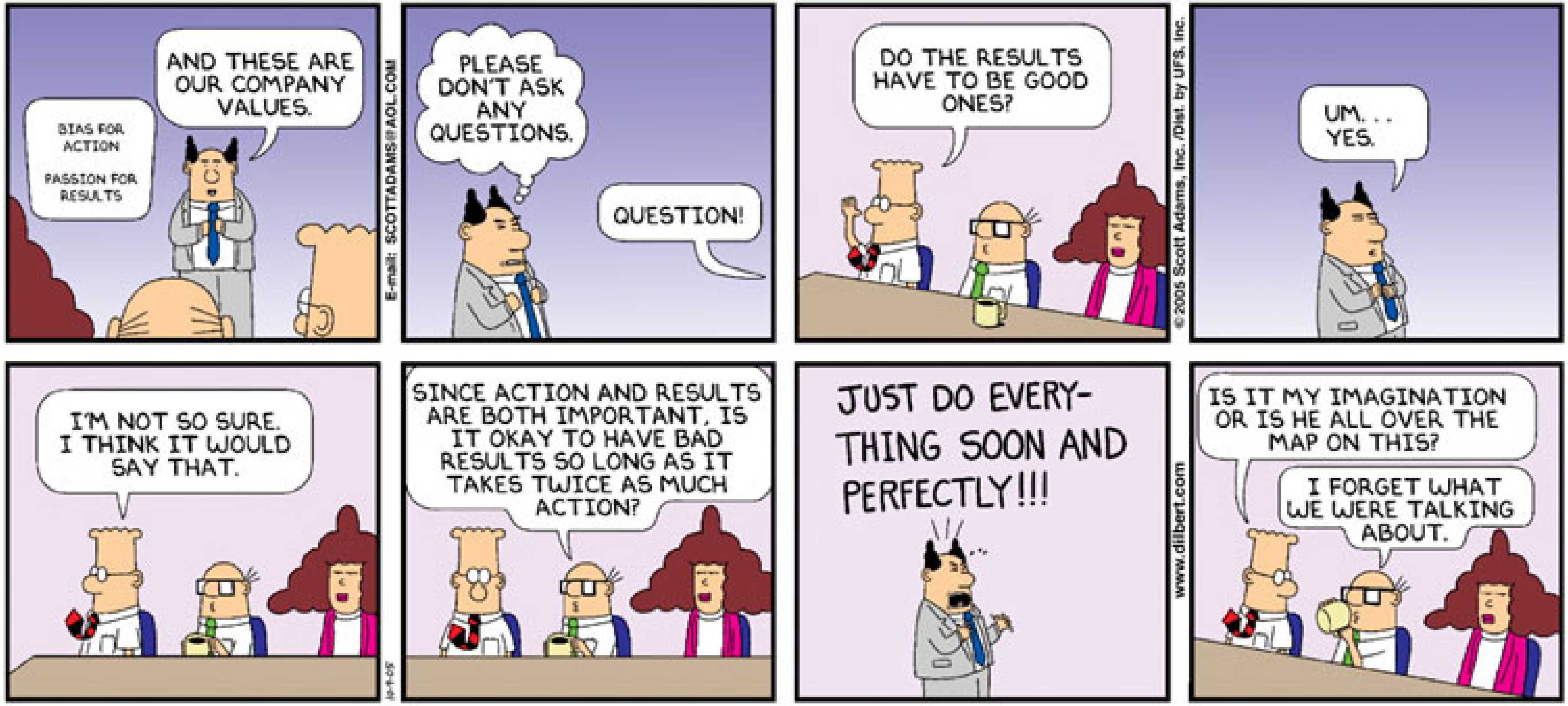
But isn't a BIAS FOR ACTION a good thing?

In the present case, perhaps not…

of too much design and not enough execution

© 2005, BRIITE

Bias for Action


BIAS FOR ACTION
PASSION FOR RESULTS
AND THESE ARE OUR COMPANY VALUES.
E-mail: SCOTTADAMS@AOL.COM
PLEASE DON'T ASK ANY QUESTIONS.
QUESTION!
DO THE RESULTS HAVE TO BE GOOD ONES?
© 2005 Scott Adams, Inc./Dist. by UFS, Inc.
UM. . . YES.
I'M NOT SO SURE. I THINK IT WOULD SAY THAT.
SINCE ACTION AND RESULTS ARE BOTH IMPORTANT, IS IT OKAY TO HAVE BAD RESULTS SO LONG AS IT TAKES TWICE AS MUCH ACTION?
JUST DO EVERYTHING SOON AND PERFECTLY!!!
www.dilbert.com
IS IT MY IMAGINATION OR IS HE ALL OVER THE MAP ON THIS?
I FORGET WHAT WE WERE TALKING ABOUT.

© Scott Adams, Inc./Dist. by UFS, Inc.

RJR – Full Disclosure

- Analysis paralysis is bad

© 2005, BRIITE

RJR – Full Disclosure

- Analysis paralysis is bad
- So is rapidly heading off in the wrong direction

Background

Insights

An Assertion

- To be truly useful, an IT professional must have some knowledge of
  - Systems analysis
  - Database theory and design
  - Networking internals and design
  - Operating systems — principles and design
  - Algorithms and programming

Systems Analysis Insights

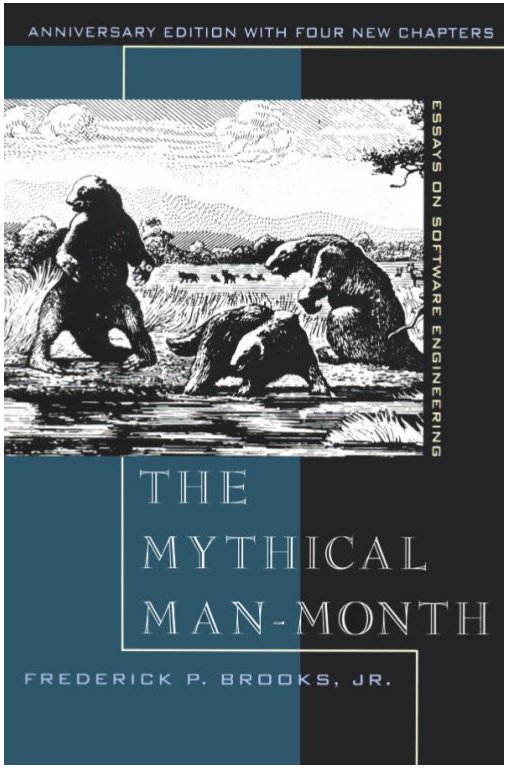
- Understand your goals / Know your tradeoffs
- Understand your resources / Manage scope
- Plan for change
- Design for maintenance
- Read *The Mythical Man Month*

© 2005, BRIITE

Systems Analysis Insights

- Understand your goals / Know your tradeoffs
- Understand your resources / Manage scope
- Plan for change
- Design for maintenance
- Read *The Mythical Man Month*

  More than once


ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS
ESSAYS ON SOFTWARE ENGINEERING
THE MYTHICAL MAN-MONTH
FREDERICK P. BROOKS, JR.

Mythical Man Month

		Multiple Platforms?	
		No	Yes
Part of a System?	No	1x	
	Yes		

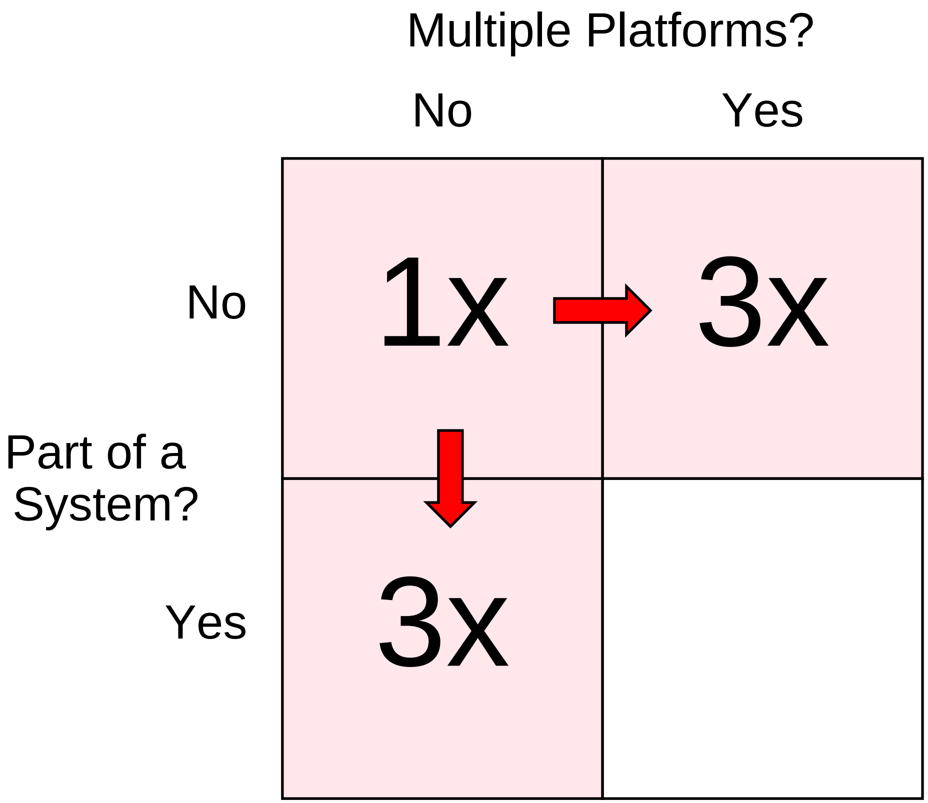
Mythical Man Month

Multiple Platforms?

Part of a System?	No	Yes
No	1x →	3x
Yes		

© 2005, BRIITE

Mythical Man Month

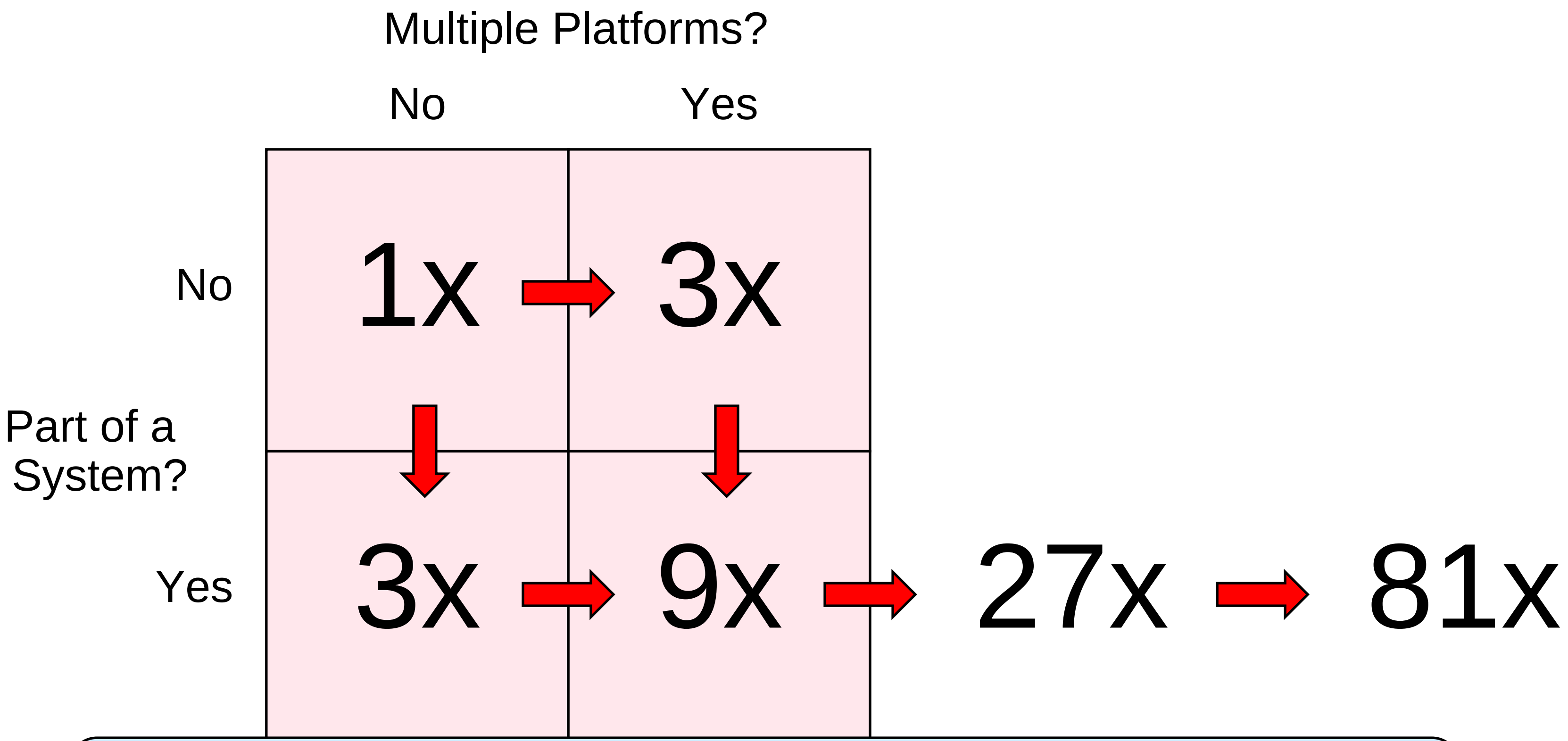


		Multiple Platforms?	
		No	Yes
Part of a System?	No	1x	3x
	Yes	3x	

Mythical Man Month

		Multiple Platforms?	
		No	Yes
Part of a System?	No	1x → ↓	3x ↓
	Yes	3x →	9x

Mythical Man Month



Multiple Platforms?

Part of a System?	No	Yes
No	1x →	3x
Yes	3x →	9x → 27x → 81x

Add networking and then federated networking and you’ve probably crossed two more complexity boundaries.

© 2005, BRIITE

Database Insights

- Build a good data model (schema)
  - Well normalized
  - Attributes must be properly attached
- Use single authoritative sources
  - Avoid duplicated data management
  - Data replication breeds data inconsistency
- Maintain database integrity

© 2005, BRIITE

Networking Insights

- Efficiency ≠ Effectiveness
- No component is always guaranteed to work
- Change is inevitable
- Simultaneous upgrades are impossible
- No one is in charge
- It has to work anyway

© 2005, BRIITE

Networking Insights II

- End-to-end protocol equivalence (interoperability) is required
- End-to-end technical equivalence is not
- End-to-end paths involve lots of negotiating and late binding of names, of technologies, and even of paths.

Algorithm Insights

- Simplicity is the goal
- Beware combinatoric explosions
- Understand algorithmic complexity
- Pay attention to scaling problems
- NP Complete ≠ impossible

  (But it’s a good approximation)

© 2005, BRIITE

Operating System Insights

- Think abstractly
- Use common abstractions
- A minimal kernel is a good kernel
- An insecure kernel ≡ an insecure system
- Modules — modules — modules

© 2005, BRIITE

General Insights

- Old ≠ Bad
- New ≠ Good
- Do not feel obliged to reinvent everything
- The 1972 reference monitor concept is still useful

Anderson, J. P. 1972. Computer Security Technology Planning Study. Technical Report ESDTR-73-51, Air Force Electronic Systems Division, Hanscom AFB, Bedford, MA. (Also available as Vol. I, DITCAD-758206. Vol. II DITCAD-772806). Available online at: http://seclab.cs.ucdavis.edu/projects/history/papers/ande72.pdf

© 2005, BRIITE

Reference Monitor

- The reference monitor mechanism must be tamper proof.
- The reference monitor mechanism must always be invoked. That is, it must govern all operations and actions on the system, including the activities of the operating system itself.
- The reference monitor mechanism must be small enough to be subject to analysis and tests to assure that it is correct. That is, it must be capable of being proved to be correct.

Reference Monitor

- The reference monitor mechanism must be tamper proof.

KEY POINT: The security mechanisms of the kernel must be small enough to function efficiently and simple enough to be UNDERSTOOD.

A “security system” that cannot be understood is not secure.

e

d

- The reference monitor mechanism must be small enough to be subject to analysis and tests to assure that it is correct. That is, it must be capable of being proved to be correct.

Beware Mindset Conflicts

DATABASE WORLD VIEW:

Every must be perfect, all of the time.

NETWORKING WORLD VIEW:

No component is ever guaranteed to work at any particular time.

Beware Mindset Conflicts

ENTERPRISE SECURITY:

We are designing technology to implement OUR security policies.

FEDERATED SECURITY:

We are designing technology to implement ANY security policies.

© 2005, BRIITE

Background

Supersets and Subsets

Personal Beliefs

- Downsizing a superset solution for a subset problem is usually easy.

Personal Beliefs

- Downsizing a superset solution for a subset problem is usually easy.
- Upsizing a subset solution to a superset problem is often hard, sometimes impossible.

Personal Beliefs

- Downsizing a superset solution for a subset problem is usually easy.
- Upsizing a subset solution to a superset problem is often hard, sometimes impossible.
- Upsizing is generally unwise; upsizing multiple times is beyond unwise.

© 2005, BRIITE

Personal Beliefs

- Downsizing a superset solution for a subset problem is usually easy.
- Upsizing a subset solution to a superset problem is often hard, sometimes impossible.
- Upsizing is generally unwise; upsizing multiple times is beyond unwise.
- Therefore, it's a good idea to know the ultimate size of your problem before going too far in the direction of a solution.

© 2005, BRIITE

Personal Beliefs

- Downsizing a superset solution for a subset problem is usually easy.

Compared with enterprise security, federated security is a superset problem.

- Therefore, it’s a good idea to know the ultimate size of your problem before going too far in the direction of a solution.

Federation Is Essential

Federation

- Biomedical Research Occurs in a Distributed Manner

© 2005, BRIITE

Federation

- Biomedical Research Occurs in a Distributed Manner
- Biomedical Research Demands Secure Information Infrastructure (criminal penalties apply when security is not met)

Federation

- Biomedical Research Occurs in a Distributed Manner
- Biomedical Research Demands Secure Information Infrastructure (criminal penalties apply when security is not met)
- Biomedical Research Needs a Federated Approach to Security and Access Control

Federation Is Different (& Hard)

Federation is Different

- Security and Access Control Systems are the means by which the people who are in charge enforce their decisions about about who should and who should not have access to the enterprise’s computing systems.

Federation is Different

- Security and Access Control Systems are the means by which the people who are in charge enforce their decisions about about who should and who should not have access to the enterprise’s computing systems.
- In a truly federated environment, THERE IS NO CONTROLLING ENTERPRISE and NO ONE IS IN CHARGE OF EVERYTHING – there is no “privileged center” to the system.

© 2005, BRIITE

Federation is Different

- Security and Access Control Systems are the means by which the people who are in charge enforce their decisions about about who should and who should not have access to the

- O CONTROLLING ENTERPRISE and NO ONE IS IN CHARGE OF EVERYTHING – there is no “privileged center” to the system.

A federated security model is NOT just a security model for a multi-site enterprise.

Federation is Different

Q: If NO ONE IS IN CHARGE, then how do we build a security and access control system?

© 2005, BRIITE

Federation is Different

Q: If NO ONE IS IN CHARGE, then how do we build a security and access control system?

A: By developing a grid of components that can be used totally independently, but which can also be integrated in subsets to deliver virtual security and access control systems for virtual organizations that choose to use the components.

Federation is Different

Q:

A

e

.

If all of the computers in one “virtual” organization happen to be run by the central IT department of one enterprise, an enterprise solution falls out of the federated model as a trivial exercise in parameter setting.

Federation is Different

Q:

A

e

.

If all of the computers in one “virtual” organization happen to be run by the central IT department of one enterprise, an enterprise solution falls out of the federated model as a trivial exercise in parameter setting.

Conversely, evolving an enterprise solution into a federated solution is very hard, if not impossible.

All Components

All the Time

All Components

- In database design, one should always model the data at the finest used resolution. That is, if a use case requires that a data element be parsed into subcomponents, then the schema should decompose that data element into finer pieces.

All Components

- In database design, one should always model the data at the finest used resolution. That is, if a use case requires that a data element be parsed into subcomponents, then the schema should decompose that data element into finer pieces.

- Federated security components should be implemented at the finest used resolution. That is, if **any supported use case** requires that a service be delivered independently, then build that service as a stand-alone component.

© 2005, BRIITE

Independent Components

- Identity Management
- Group Membership Management
- Role Definitions
- Authentication
- Authorization
- Auditing
- More…

© 2005, BRIITE

Component Usage

- In a truly federated environment, security and access control depend upon the availability of technically secure components that can be deployed in any way a user chooses (so long as the usage matches the technical specifications for the components).

Component Usage

- In a truly federated environment, security and access control depend upon the availability of technically secure components that can be deployed in any way a user chooses (so long as the usage matches the technical specifications for the components).
- Users must be free to use the components in as sophisticated (or as stupid) a manner as they choose.

Making it Work

Logical Simplicity

Logical Simplicity

- In a federated, component-based environment, the biggest challenge is managing complexity.
- This requires a commitment to simplicity.
- Components must be entirely self-contained.
- All inter-component communication occurs only through well defined protocols and interfaces.
- Systems must be designed to accommodate change.

Driving Assumption

- Many use case requirements across the federation will be inconsistent and some will be genuinely contradictory.

© 2005, BRIITE

Driving Assumption

- Many use case requirements across the federation will be inconsistent and some will be genuinely contradictory.
- The federation must work anyway.

© 2005, BRIITE

Making it Work

Social Scalability

Social Scalability

- In a truly federated environment, long term success for a federated security model will depend upon social scalability.

Social Scalability

- In a truly federated environment, long term success for a federated security model will depend upon social scalability.
- Social scalability CANNOT be achieved through normative pronouncements.

Social Scalability

- In a truly federated environment, long term success for a federated security model will depend upon social scalability.
- Social scalability CANNOT be achieved through normative pronouncements.
- Experience suggests that social scalability is best achieved through a combination of pure laissez faire individualism and social consequences – i.e., social contracts.

Social Scalability

- In a truly federated environment, long term success for a federated security model will depend

- gh

- st achieved through a combination of pure laissez faire individualism and social consequences – i.e., social contracts.

Negotiated social contracts – not mandated technical solutions – drive the emergence of standards in a federation.

Social Contracts

- Every individual is free to do whatever he/she chooses.

Social Contracts

- Every individual is free to do whatever he/she chooses.
- Every other individual is free to respond however he/she chooses.

© 2005, BRIITE

Social Contracts

- Every individual is free to do whatever he/she chooses.
- Every other individual is free to respond however he/she chooses.
- Interactive relationships then sort things out.

Social Contracts

- Every individual is free to do whatever he/she chooses.
- Every other individual is free to respond however he/she chooses.
- Interactive relationships then sort things out.
- Examples:

  One cuts, the other chooses.

Social Contracts

- Every individual is free to do whatever he/she chooses.
- Every other individual is free to respond however he/she chooses.
- Interactive relationships then sort things out.
- Examples:

  I am free to suppress my caller ID; if I do, you are free to refuse to answer my calls.

© 2005, BRIITE

Social Contracts

- Every individual is free to do whatever he/she chooses.
- Every other individual is free to respond however he/she chooses.
- Interactive relationships then sort things out.
- Examples:

  You are free to run your systems in as stupid and insecure manner as you choose; if you do, I am free to refuse to have anything to do with your systems.

© 2005, BRIITE

Logical Issues

- Rules governing behavior can be permissions or prohibitions.

© 2005, BRIITE

Logical Issues

- Rules governing behavior can be permissions or prohibitions.
- The union set of contradictory permissions is a very flexible environment.

Logical Issues

- Rules governing behavior can be permissions or prohibitions.
- The union set of contradictory permissions is a very flexible environment.
- The union set of contradictory prohibitions is the null set.

Logical Issues

- Rules governing behavior can be permissions or prohibitions.
- The union set of contradictory permissions is a very flexible environment.
- The union set of contradictory prohibitions is the null set.
- Use case requirements across a federation will be contradictory.

Logical Issues

- Rules governing behavior can be permissions or

If a federated security system is to deliver services greater than the null set, it must be technically implemented on the aggregation of permissions, not prohibitions.

Behavioral constraints should be achieved on a virtual organization basis, through negotiated social contracts.

contradictory.

© 2005, BRIITE

Logical Issues

- Rules governing behavior can be permissions or

For example, the components of a federated security system must permit users to behave in a highly secure manner, but it should not mandate that users do so.

contradictory.

Logical Issues

- Rules governing behavior can be permissions or
-
- ne
- be contradictory.

For example, the components of a federated security system must permit users to behave in a highly secure manner, but it should not mandate that users do so.

Negotiated social contracts will then determine who interacts with whom, with what security levels.

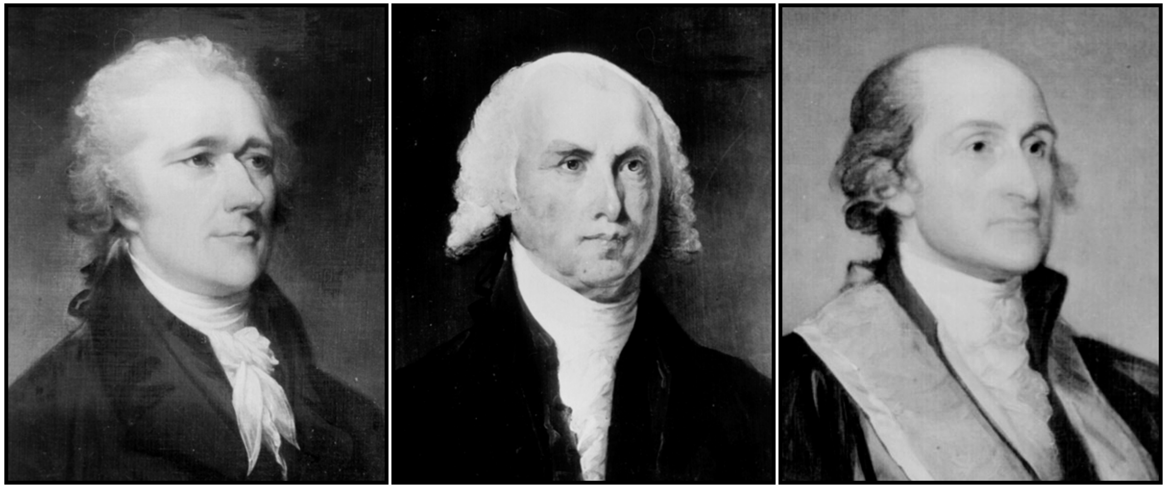
© 2005, BRIITE

Social Scalability:

Required Reading

Alexander Hamilton — James Madison — John Jay

The Federalist Papers

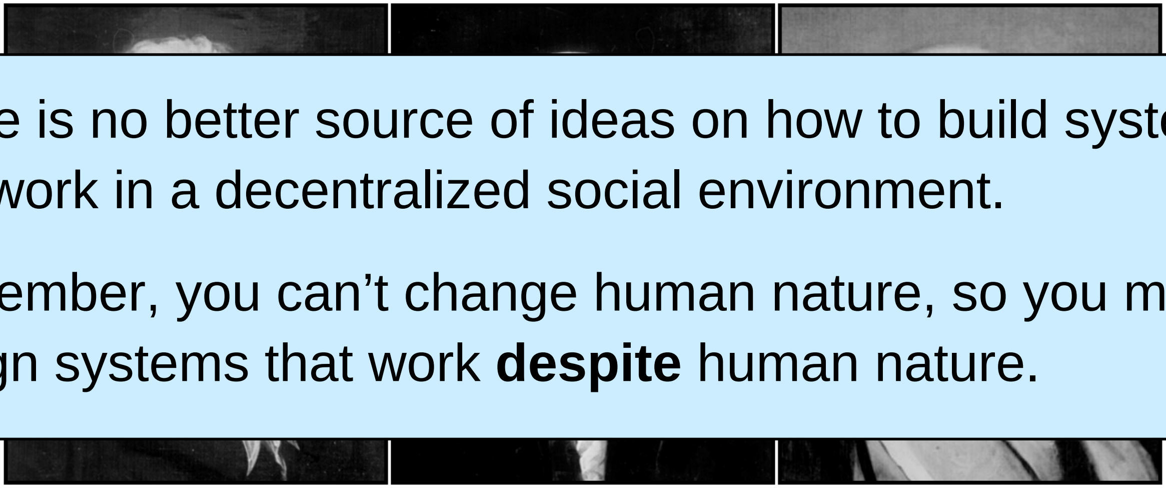


Social Scalability:

Required Reading

Alexander Hamilton — James Madison — John Jay

The Federalist Papers



There is no better source of ideas on how to build systems that work in a decentralized social environment.

Remember, you can’t change human nature, so you must design systems that work **despite** human nature.

The Problem

Problem Components

- Systems Analysis
- Database
- Networking
- Operating System
- Algorithms

Systems Analysis Challenges

- What am I trying to do?
- What are my constraints?
  - Technical
  - Social
- How to allow for change?
  - Growth in size and complexity
  - Conceptual extensibility
  - Technological Advance and Upgrades

Database Challenges

- What information do I need to manage?
- What's my best schema?
- How should the schema be partitioned?
    - Vertically?
    - Horizontally?
    - Both?
- What can I do to ensure data quality?

© 2005, BRIITE

Networking Challenges

- How to handle name resolution and resource discovery?
- What are the sources of dynamism?
  - System failure
  - Local changes
  - Technical advance
- How to allow for dynamism?
  - Protocol negotiation
  - Late binding

© 2005, BRIITE

Networking Challenges

- Dealing with distributed information:
  - Authoritative sources
  - Proxy servers
  - Local caches
  - Time-to-live parameters

Operating System Challenges

- How to hook the permissions to the OS?
- How to achieve variable resolution OS support?
  - Login
  - Application access
  - Application operation
- How to achieve OS-level logs and audits?
- How to integrate with OS, but still achieve OS portability for code?

Algorithmic Challenges

- Understanding the complexity of the algorithms
- Achieving acceptable performance
  - Good algorithms
  - QoS monitoring / graceful failure

Possible Solution

Basic Issus

GlAAAS as a Solution

- A truly useful, totally decentralized federated access-control system would be a
  - **Gl**obal
  - **A**uthentication
  - **A**uthorization
  - **A**ccess Control
  - **A**uditing
  - **S**ystem
- That is: GlAAAAS

TCP / IP as a Model

- TCP/IP protocols are content agnostic
- TCP/IP protocols can move ANY “file”
- This is good: do not need separate networks for different data types
- This is bad: digital vermin move just as effectively as digital content
- Ultimately: local acceptable-use policies determine what is permitted

Black Box Models

- A black box model is a formal documentation of a program’s function, in terms of inputs and outputs, with no concern for the program’s internal technical implementation. A black box description records WHAT a program will do.
- Accompanying the black box description is a “clear box” analysis that documents the technical internal technical implementation. A clear box description records HOW a program will do what it does.

Black Box Models

- A black box model of GlAAAAS would be a formal description that documents the permission decisions to be made, the rules governing the decisions, the information necessary to make the decisions, and the source(s) of the required information.
- A sociological black box description describes WHO will make the rules, WHO will provide the relevant information, and WHO will decide if the information sources are reliable. And, WHO is accountable form security failure.

Clear Box Models

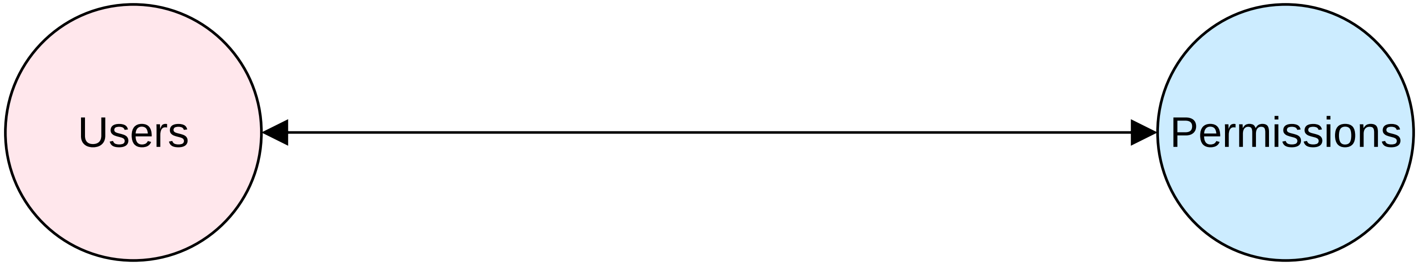
- A clear box model of GlAAAAS would be a formal description that documents the technical implementation of GlAAAAS. HOW is authentication to be accomplished, HOW is information to be transmitted securely, HOW to deal with proxied requests, HOW to hook into the OS, HOW …

Possible Solution

GIAAAAS

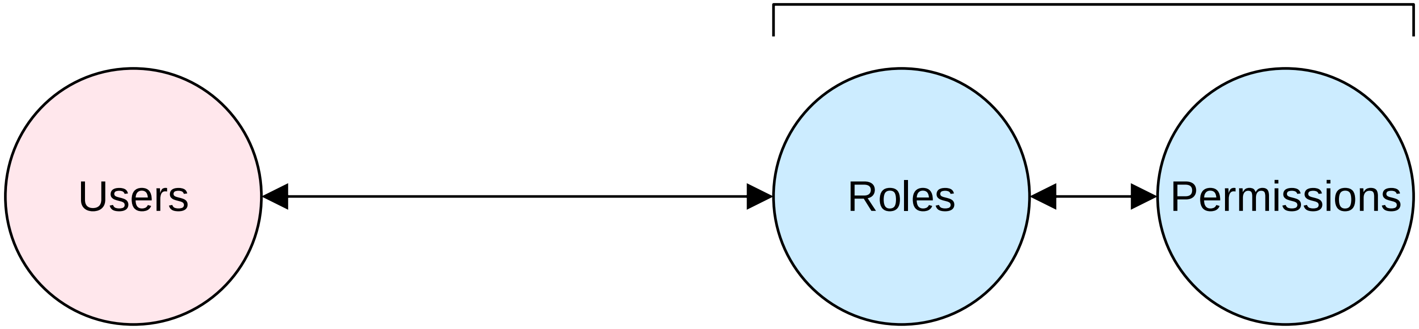
GlAAAAS

Groups vs. Roles



When users access computer resources they must be assigned specific permissions in order to carry out useful tasks.

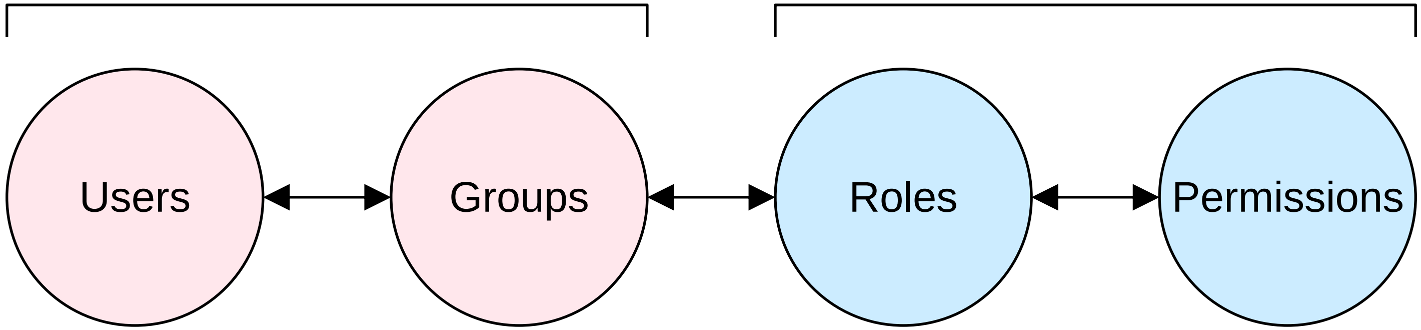
Groups vs. Roles



To simplify the management of the user-by-permissions matrix we can aggregate sets of permissions (necessary to accomplish some coherent set of tasks) and bundle them as **ROLES**.

© 2005, BRIITE

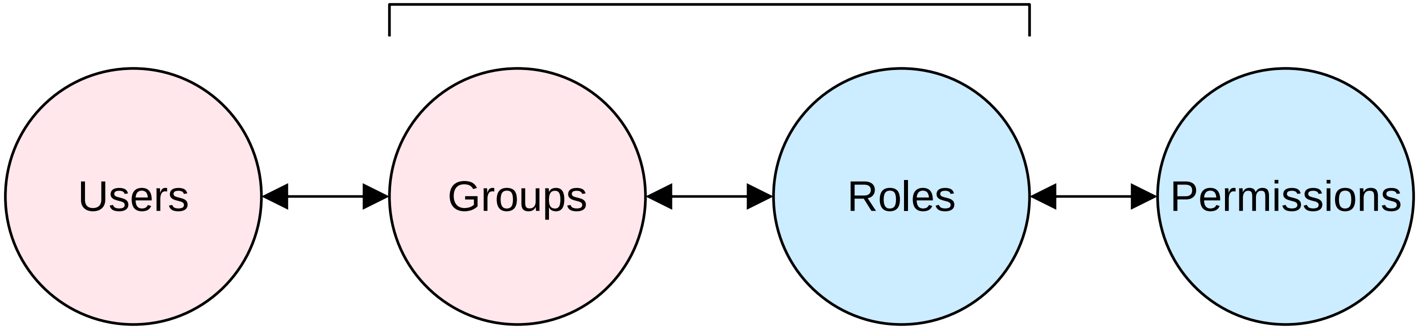
Groups vs. Roles



Similarly, we can also identify sets of users (with similar attributes) and bundle them as **GROUPS**.

Maximum efficiency is gained when we manage the permission matrix by assigning **ROLE** permissions to **GROUPS** of users.

Groups vs. Roles

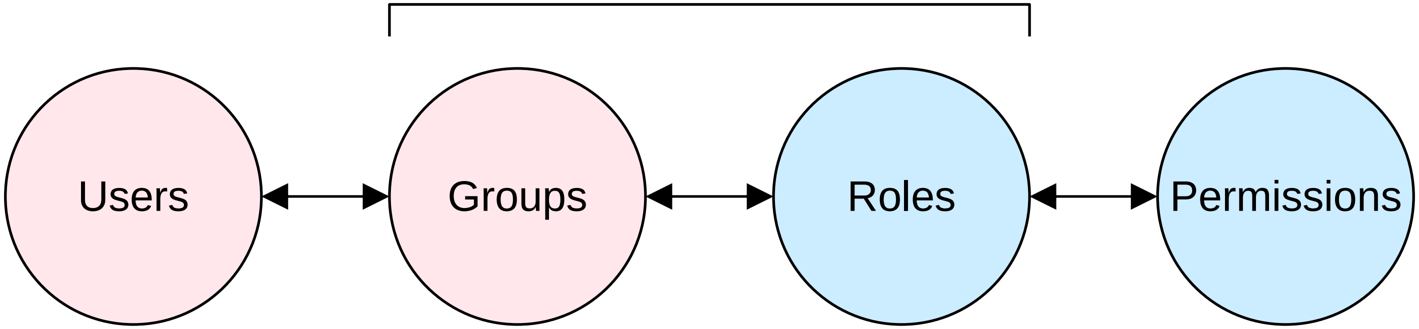


Within an enterprise, however, this can sometimes appear redundant.

That is, people are often placed into GROUPS based on their job function and permission ROLES are often created to allow people in a particular job function to accomplish their tasks.

This problem is exacerbated by the linguistic problem that within an enterprise people are often placed into a GROUP based on their job function, or “role” within the enterprise.

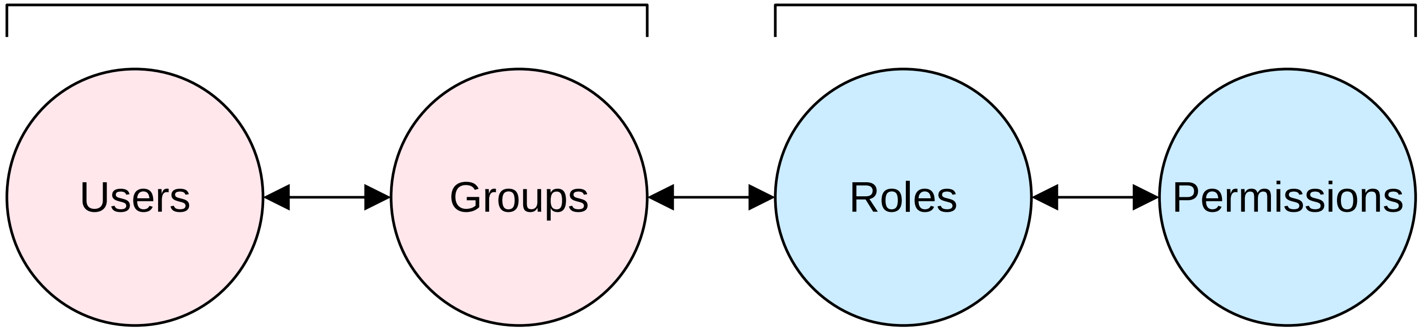
Groups vs. Roles



This apparent redundancy has led some to argue that the GROUP and ROLE concept should be combined.

Such a combination violates the logical distinction between the concepts and is akin to denormalizing a database schema in order to improve performance.

Groups vs. Roles



Within a totally decentralized federation, however, the notions of groups and roles MUST BE KEPT DISTINCT and MUST BE IMPLEMENTED SEPARATELY.

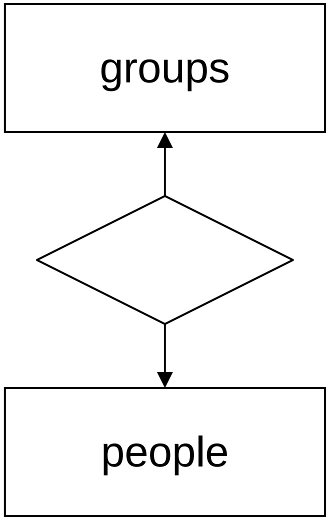
Efforts to build a federated identity management system that does not maintain this separation will be inadequate and will ultimately result in significant disappointment.

Groups vs. Roles

- The ideas of “groups” and “roles” have both been used to describe how collections of permissions can be assigned to collections of users.
- The concepts have been only partially distinct and some authors have used them almost interchangeably. Others have argued that one concept is preferred and the other should be deprecated.
- In the context of a TDCF, however, the concepts are quite distinct and both are needed.

© 2005, BRIITE

Groups vs. Roles

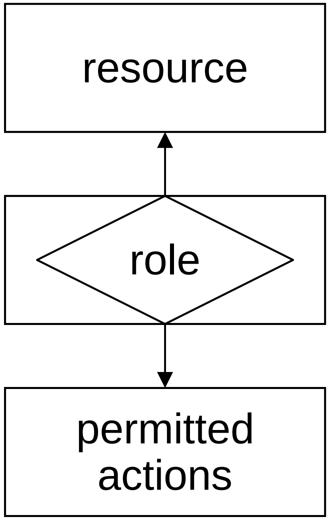


- Groups are collections of people
- Criteria for membership in a group is strictly up to the manager of that group (e.g., could be “officers of company X” or “physicians with attending privileges at hospital Z” or “people whose birthday is a prime number”)
- Management of group membership can be done informally or formally (i.e., with an audit trail)

© 2005, BRIITE

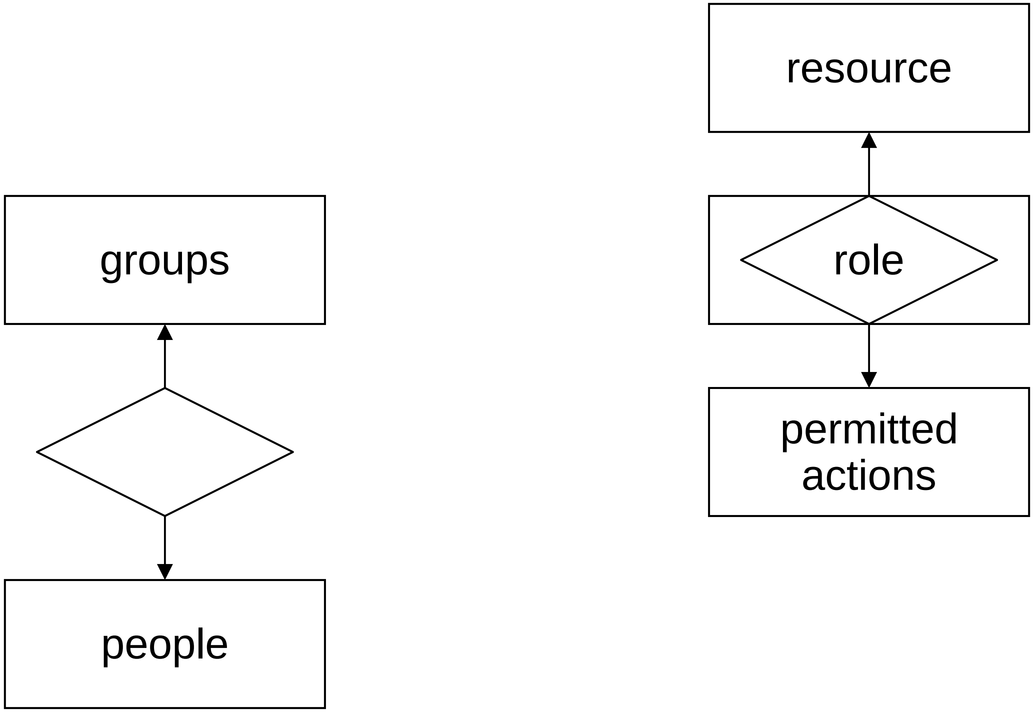
Groups vs. Roles

- Roles are aggregations of permitted actions that a user may take on a computer resource (e.g., the role of standard user or superuser or DBA)
- Roles are associated with computer resources (e.g., the role of standard user on computer X)
- The manager of a resource determines what roles are to be made available on the resource.



© 2005, BRIITE

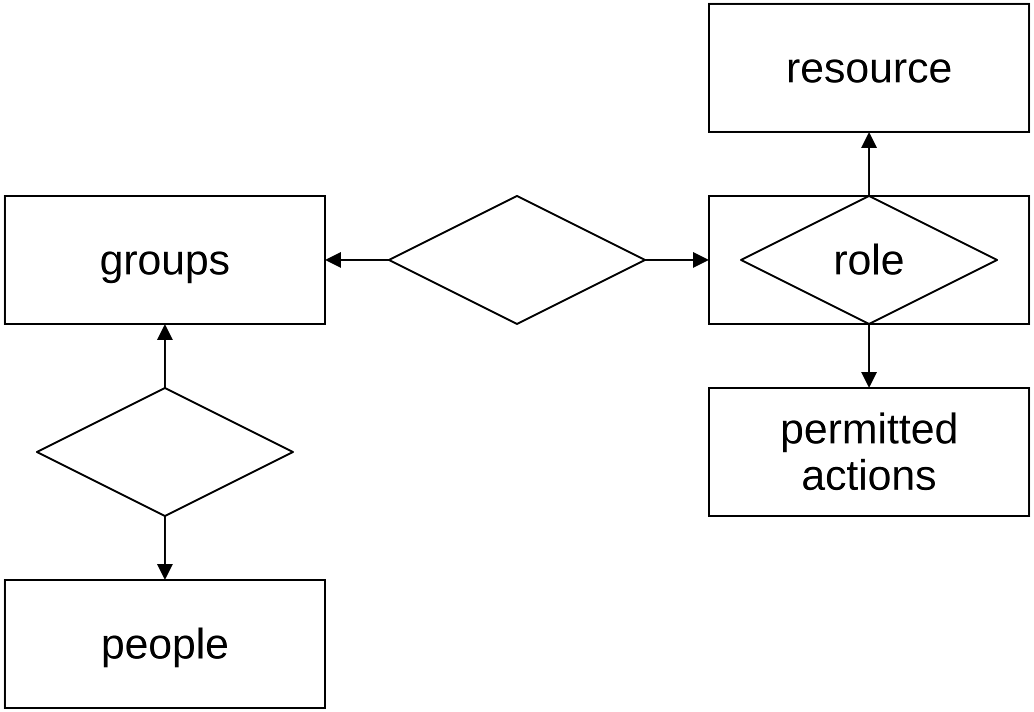
Groups vs. Roles



Authorization Joins Groups & Roles

© 2005, BRIITE

Groups vs. Roles

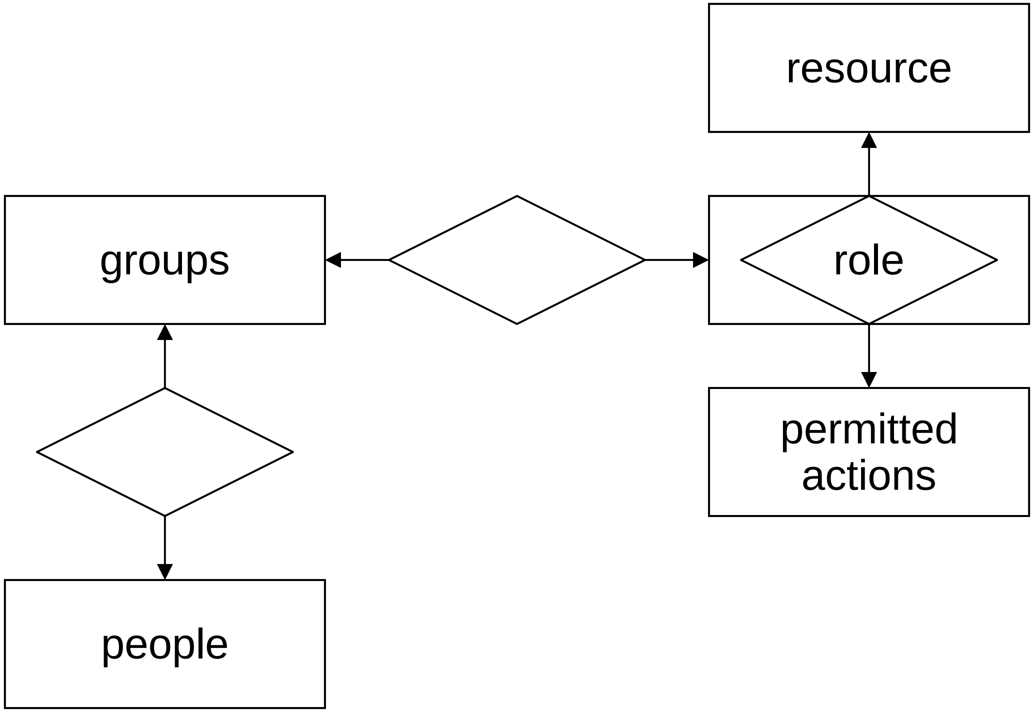


Prior authorization occurs when a resource manager grants permission to members of a Group X to act in Role Y on Resource Z.

Real-time authorization occurs when a user requesting access to a resource is determined to satisfy a prior-authorization rule set.

© 2005, BRIITE

Groups vs. Roles



NOTE: In an enterprise-free federation, it is not possible (indeed, it is inconceivable) that group membership in any particular group could always control the permission to act in a particular role on an arbitrary resource. Therefore, in a federation **IT IS ESSENTIAL THAT A CLEAR LOGICAL AND TECHNICAL DISTINCTION BE MADE BETWEEN THE CONCEPTS OF GROUPS AND ROLES.**

© 2005, BRIITE

Federation Requirements

- There is NO central enterprise.
- Everything is (potentially) decentralized:
  - Identity Management
  - Group Membership
  - Authentication
  - Authorization
  - Auditing
- Participation is voluntary
- Solutions must scale, technically and socially.

© 2005, BRIITE

Federation Requirements

- **Components of the Problem**

  The first step in approaching a solution is examining the fundamental questions: (a) **who** will manage the various components of security-relevant information, (b) **what** information must be available and communicated to accomplish appropriate access control, (c) **when** updates to the information will occur, (d) **where** the various components of security-relevant information will be managed, (e) **why** trust should be extended to security information managed by a different organization, and (f) **how** the necessary communications are themselves accomplished in a secure manner.

Federation Requirements

- **Remember the Reference Monitor Concept**

  The access-control system must be simple enough that it can be understood.

  A permission system based on arbitrary logic over arbitrary attributes served up from (marginally controlled) vocabularies is not likely to be simple.

© 2005, BRIITE

Federation Requirements

- **Remember the Reference Monitor Concept**

  But, simple logic and set theory says that any attribute (or set of attributes) for any object can be converted into a statement about set (or group) membership.

  A simple Boolean statement over one data type (group membership) that must evaluate to true or false (or unknown) can be understandable.

  Permissions based on (and only on) group membership can trivially be extended to include negative permission.

Federation Requirements

- **Data Requirements**

  Globally unique identifiers for

  - People
  - Groups
  - Rule Sets

Federation Requirements

- **Data Source Requirements**

  Conceptually, the data sources for all of these must be partitioned both vertically and horizontally.

  Note that it is **inconceivable** that all relevant AND RELIABLE group membership information in a TDF can come from the same source that provides identity management and authentication.

  Once you have the need to support more than one source of information you have a need to support n sources.

Definitions

IDENTITY:

the reliable association of a particular digital identifier with a particular human being

AUTHENTICATION:

the process by which one determines that a particular use of a digital identifier is being invoked by (or on behalf) of the person it names

Definitions

PERMITTED ACTION:

an individual activity that may be performed on a particular resource.

PROHIBITED ACTION:

an activity that may be explicitly prohibited on a particular resource

© 2005, BRIITE

Definitions

ROLE:

aggregations of permitted and prohibited actions on a particular information resource

PERMITTED ACTOR:

a person (or proxy) who can be granted permission to act in one or more roles on a particular information resource.

Definitions

GROUPS:

aggregations of people (actors)

GROUP MANAGEMENT SYSTEM:

a system for managing group-membership assignments. To be federation-ready, a group-management system (GMS) should be capable of managing group memberships for individuals whose identities are managed elsewhere in the federation.

© 2005, BRIITE

Definitions

AUTHORIZATION:

the granting of permission to members of a group to act in a particular role on a particular resource. Note that authorization itself should be authorized, and an audit trail of authorizations should always be available.

PROHIBITION:

the forbidding of members of a group to act in a particular role on a particular resource.

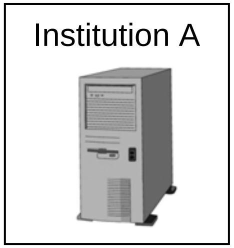
Definitions

PERMISSION MANAGEMENT SYSTEM:

a system that manages information to facilitate the unambiguous assignment of permission (or prohibition) for members of group “G” to act in role “R” on system “S”. To be federation ready, a permission-management system should be capable of maintaining rules, the components of which are all defined elsewhere in the federation.

GlAAAS
In Action

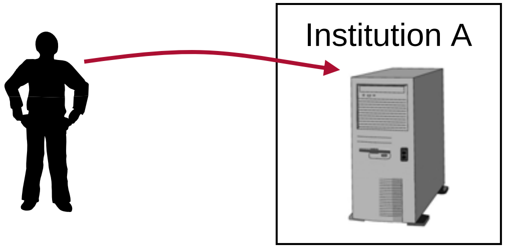
GlAAAAS



Institution A

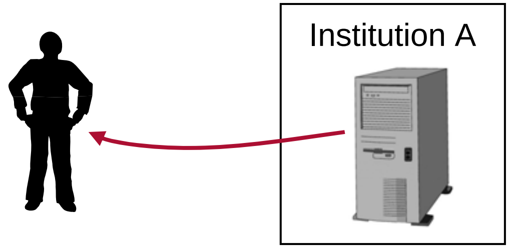
Institution A maintains a database resource associated with a multi-site clinical trial head-quartered elsewhere. Access to the database is tightly controlled according to rules based on groups to which individual requesting access belongs.

GlAAAAS



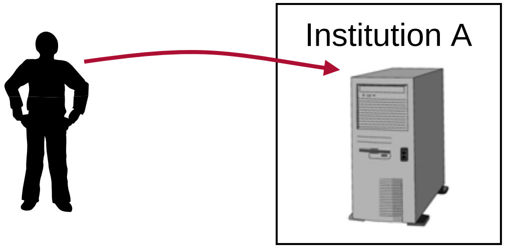
Dr. Jones attempts to access the research database maintained at Institution A.

GlAAAAS



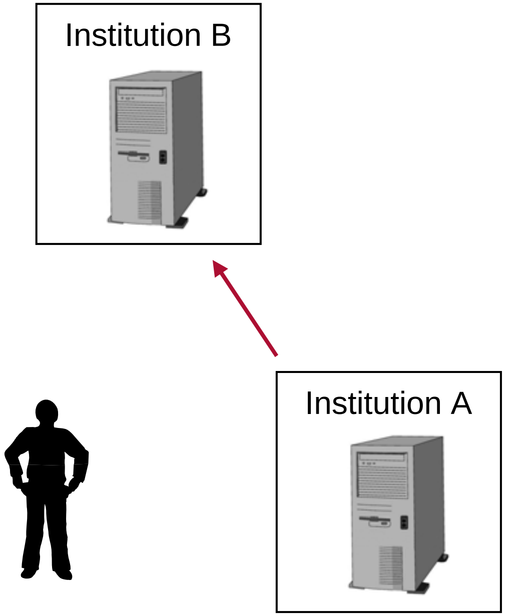
The database resource responds by asking, WHO ARE YOU AND WHERE ARE YOU FROM?

GlAAAAS



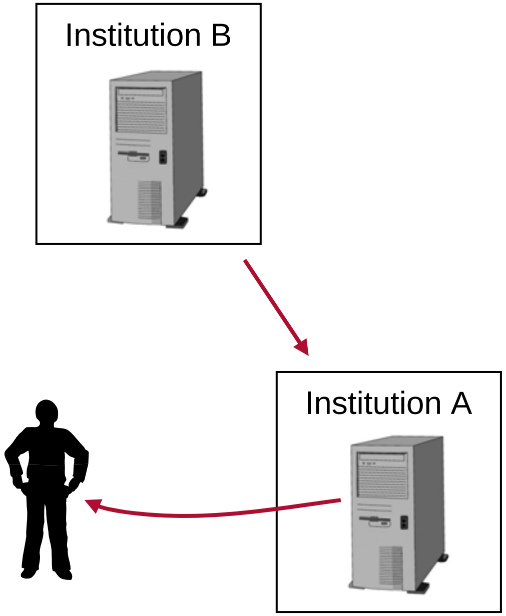
Dr. Jones replies, I AM DR JONES FROM INSTITUTION B.

GlAAAAS



The database resource asks Institution B, WHAT INFORMATION DO I NEED TO COLLECT TO AUTHENTICATE DR JONES?.

GlAAAAS

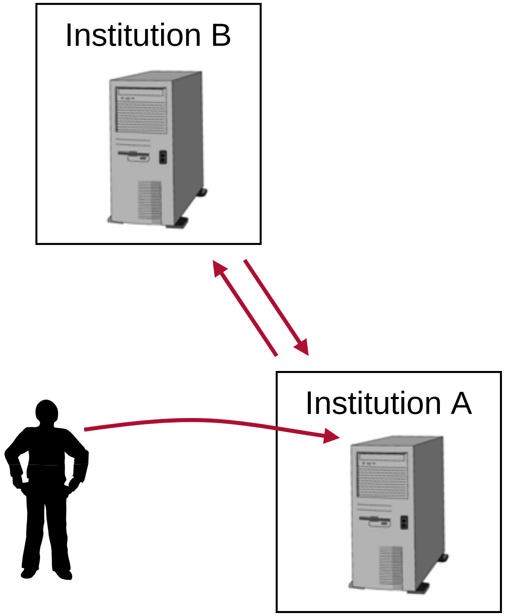


Institution B sends appropriate information and the database resource presents Dr. Jones with a login interface.

.

© 2005, BRIITE

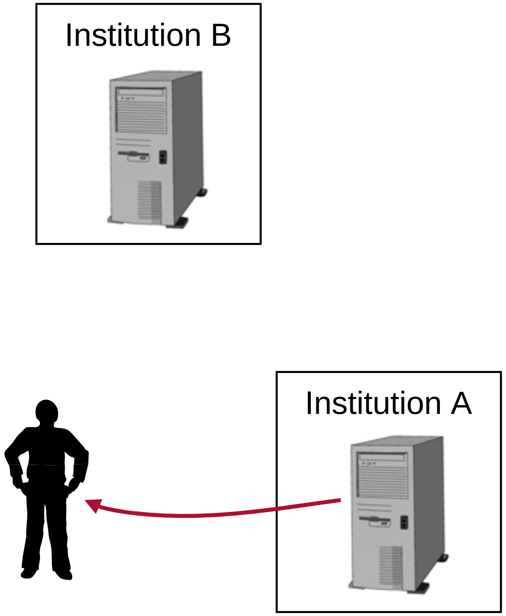
GlAAAAS



Jones responds to the login interface, A sends the information to B, and B responds: THAT IS OUR DR JONES.

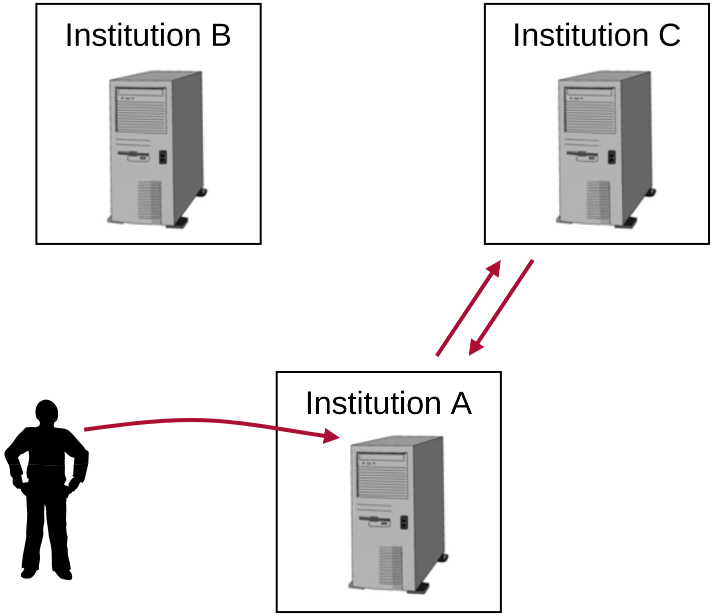
© 2005, BRIITE

GlAAAAS



The database resource checks its authorization information and determines that users can access the database in several different roles, including GUEST FACULTY, RESEARCH FACULTY, and DBA. The resource asks Dr. Jones to specify the role he wishes to use.

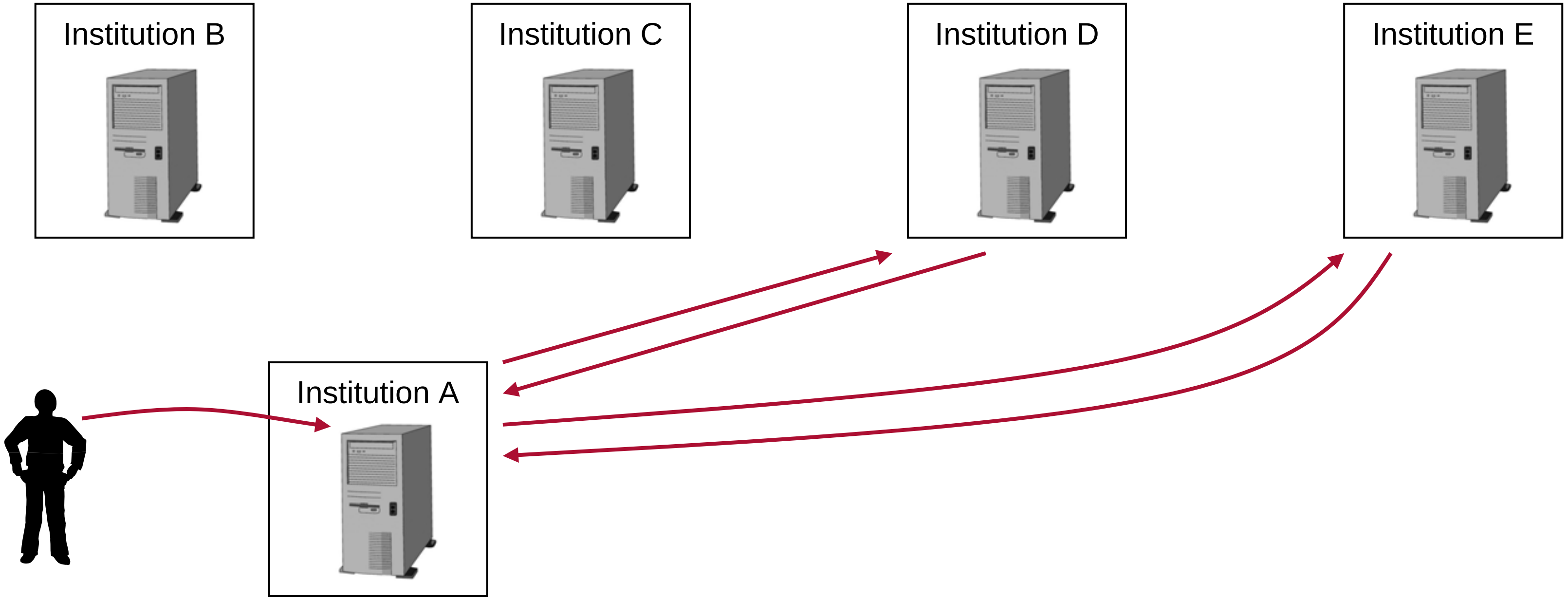
GlAAAAS



Jones responds: RESEARCH FACULTY. The database resource knows that the group-membership rule sets governing access to the clinical-trial resources are maintained at Institution C. The database resource queries the rule-server at C to obtain the latest rule set.

© 2005, BRIITE

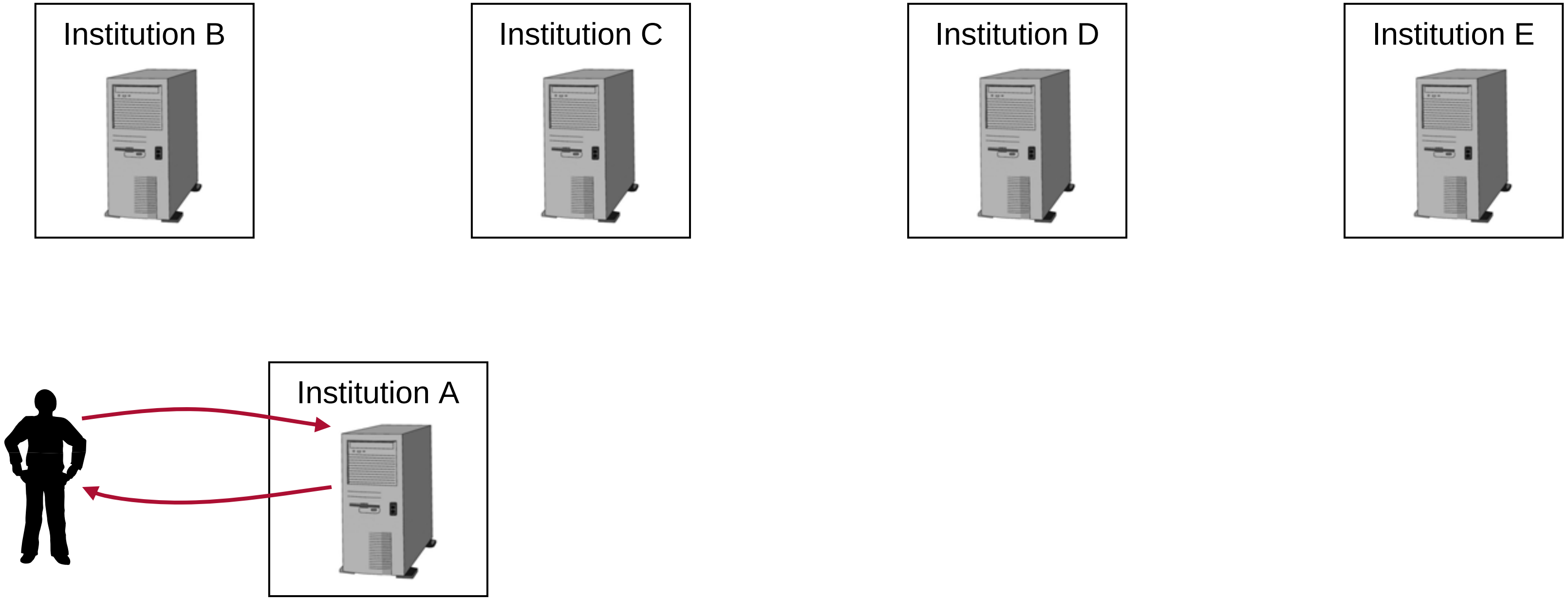
GlAAAAS



The rules show that the role is PERMITTED to individuals who are in the APPROVED FACULTY group maintained at the clinical trial headquarters at Institution D. The rules also stipulate that the role is EXPLICITLY PROHIBITED for individuals who are in the CONFLICT OF INTEREST group maintained by a watchdog organization at Institution E.

© 2005, BRIITE

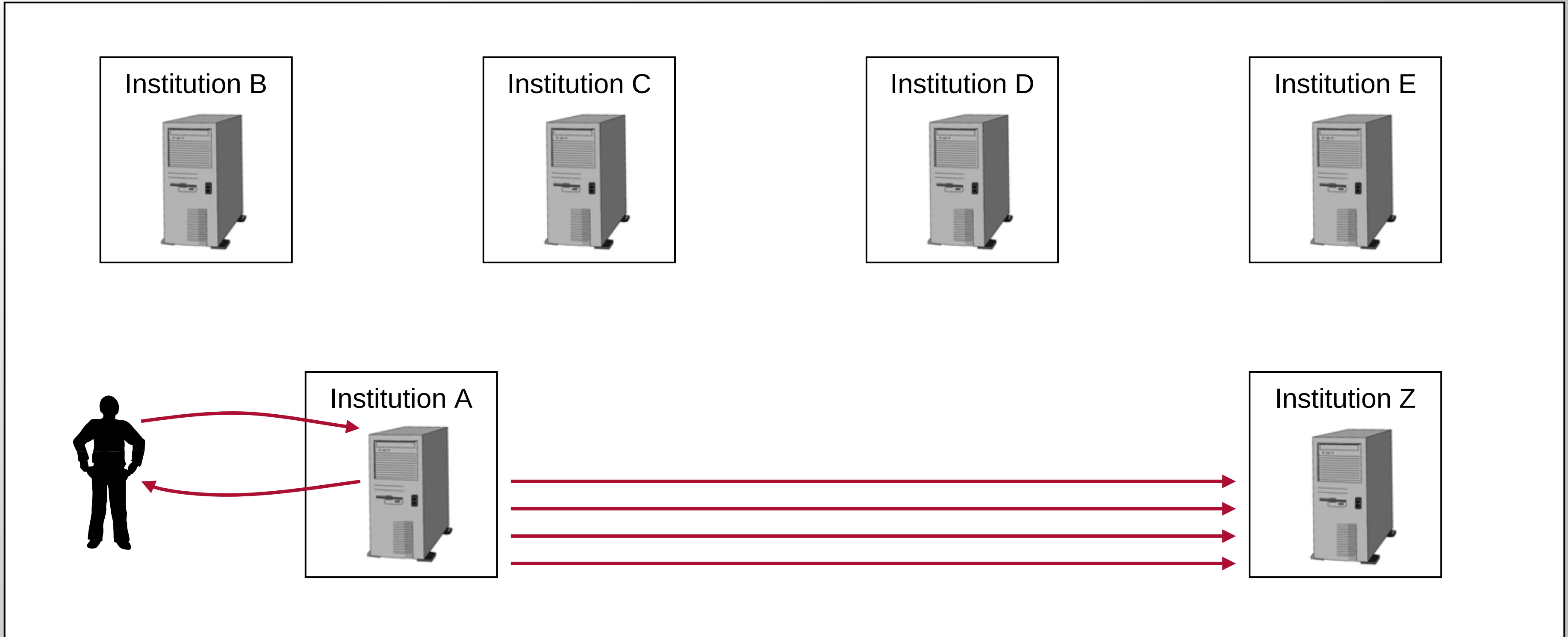
GlAAAAS



Jones is a member of the permitted group and he is not a member of the prohibited group. Therefore, he is authorized to access the database in the role of RESEARCH FACULTY. To decide whether or not to allow Jones in, the database resource used information maintained at four other, independent organizations. The decision to use these other resources was a local decision.

© 2005, BRIITE

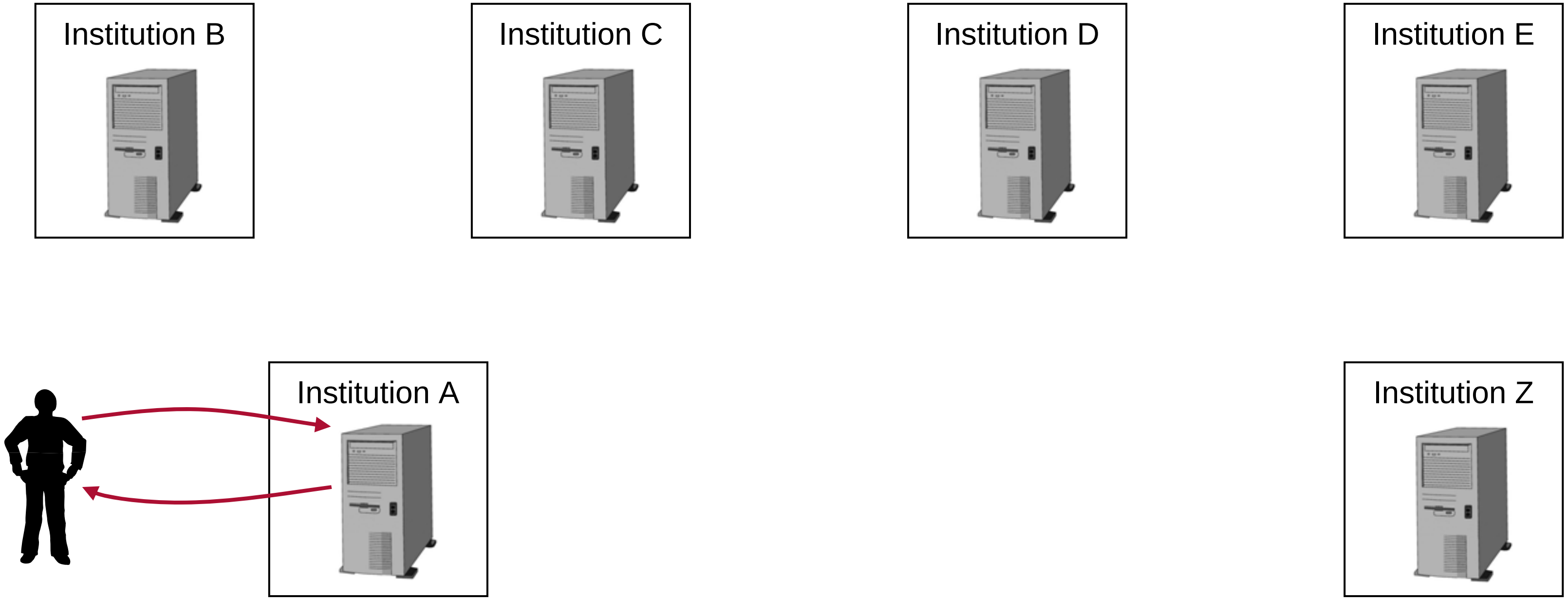
GlAAAAS



According to the auditing rules governing the database, Jones' request to access the database, his authorization to access the database, and all of his activities while accessing the database are logged in a logging system maintained at Institution Z. Now five other institutions have been involved in permitting and tracking Jones' use of the database resource.

© 2005, BRIITE

GlAAAAS



Although multiple resources were involved in the access-control process, the logical was simple: (1) determine who is requesting access, (2) determine the roles and rule sets governing access, (3) determine the user’s membership in the relevant groups, (4) decide to grant or prohibit permission based on a simple Boolean evaluation over a rule set, and (5) log all activities.

Reality Check

What’s Really Possible

What Should Be Done

Reality Check

Left as an exercise for the audience...

What's Really Possible

What Should Be Done

END