Globus Toolkit: Authentication and Credential Translation

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http://www.globus.org/

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Outline

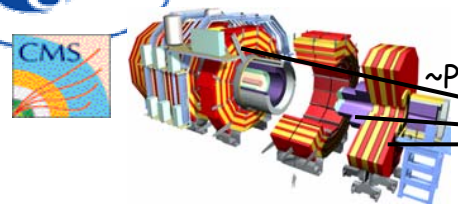
- Globus Alliance & Globus Toolkit
- The Grid “problem”
- Globus Security Infrastructure (GSI)
- Public Key Credentials + Proxy-Certificates
- SSL, GSSAPI/GSI and Delegation
- Kx509: Kerberos => PK
- Pkinit: PK => Kerberos
- GridLogon: username/password/OTP => PK
- Futures and Conclusion

The Globus™ Alliance

Making Grid computing a reality

- Argonne, UC, USC/ISI, EPCC, PDC, NCSA
- Close collaboration with many scientific and commercial Grid application and infrastructure projects
- Development and promotion of standard Grid protocols to enable interoperability and shared infrastructure
- Development and promotion of standard Grid software APIs and SDKs to enable portability and code sharing
- The Globus Toolkit® software: Open source software base for building Grid infrastructure and applications

LHC Data Distribution



~PBytes/sec

Online System

~100 MBytes/sec

1 TIPS is approximately 25,000 SpecInt95 equivalents

There is a "bunch crossing" every 25 nsecs.
There are 100 "triggers" per second
Each triggered event is ~1 MByte in size

Offline Processor Farm
~20 TIPS

~100 MBytes/sec

Tier 0

CERN Computer Centre

~622 Mbits/sec
or Air Freight (deprecated)

Tier 1

France Regional Centre

Germany Regional Centre

Italy Regional Centre

FermiLab ~4 TIPS

~622 Mbits/sec

Tier 2

Caltech ~1 TIPS

Tier2 Centre ~1 TIPS

~622 Mbits/sec

Institute ~0.25TIPS

Physics data cache

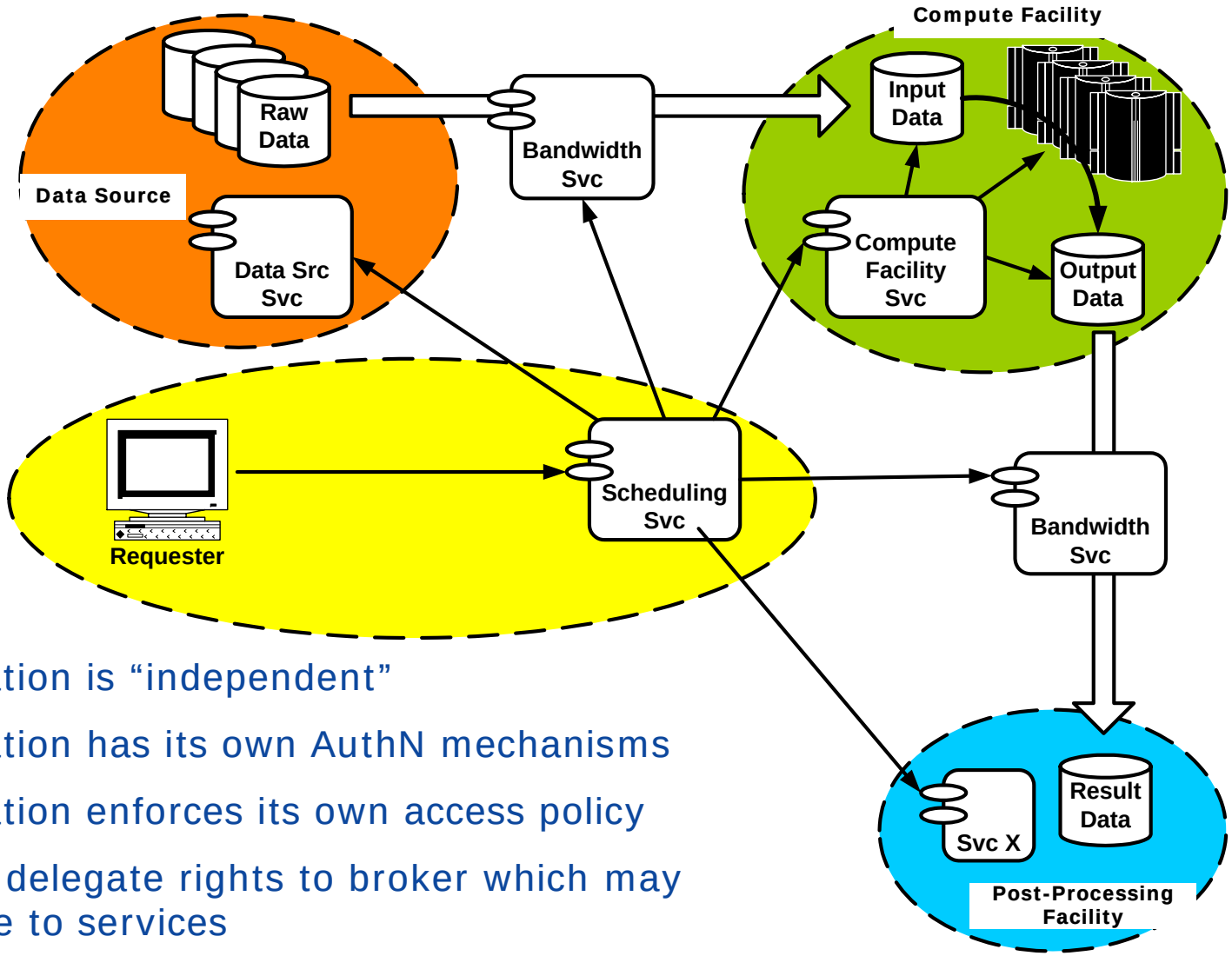
~1 MBytes/sec

Tier 4

Physicist workstations

Physicists work on analysis "channels".
Each institute will have ~10 physicists working on one or more channels; data for these channels should be cached by the institute server

Multiple Security Domains



- Each Organization is “independent”
- Each Organization has its own AuthN mechanisms
- Each Organization enforces its own access policy
- User needs to delegate rights to broker which may need to delegate to services
- QoS/QoP Negotiation and multi-level delegation

Grid Security Infrastructure (GSI)

- Based on standard PKI technologies
  - SSL protocol for authentication, message protection + GSSAPI-mechanism
  - CAs allow one-way, light-weight trust relationships (not just site-to-site)
- X.509 Certificates for asserting identity
  - for users, services, hosts, etc.
- Proxy Certificates
  - GSI extension to X.509 certificates for delegation, single sign-on

Grid Security Infrastructure (GSI)

- Use GSI as a standard mechanism for bridging disparate security mechanisms
  - Doesn't solve trust problem, but now things talk same protocol and understand each other's identity credentials
  - Basic support for delegation, policy distribution
- Translate from other mechanisms to/from GSI as needed
- Convert from GSI identity to local identity for authorization

Grid Identity, Local Policy

- In current model, all Grid entities assigned a PKI identity.
- User is mapped to local identities to determine local policy.

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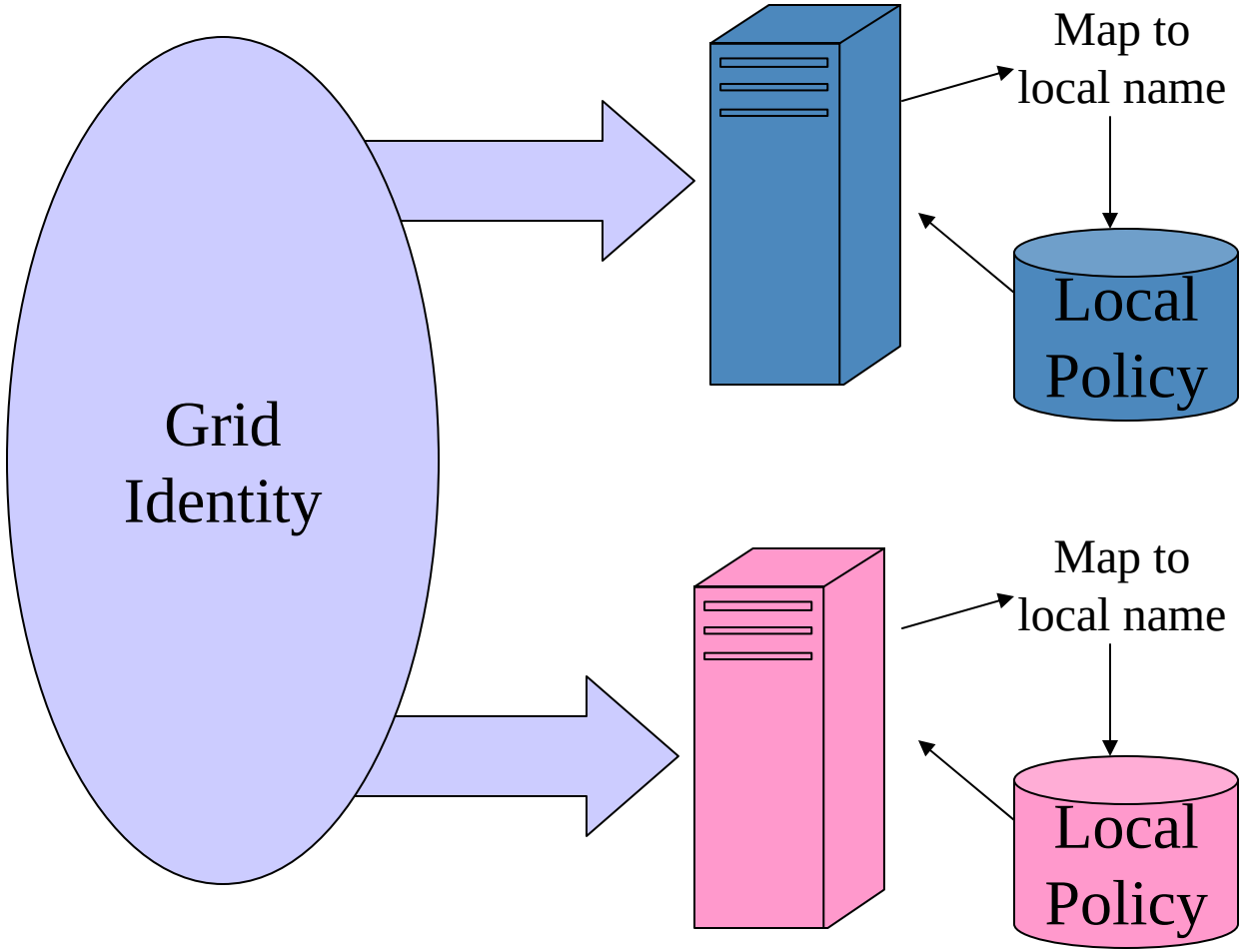
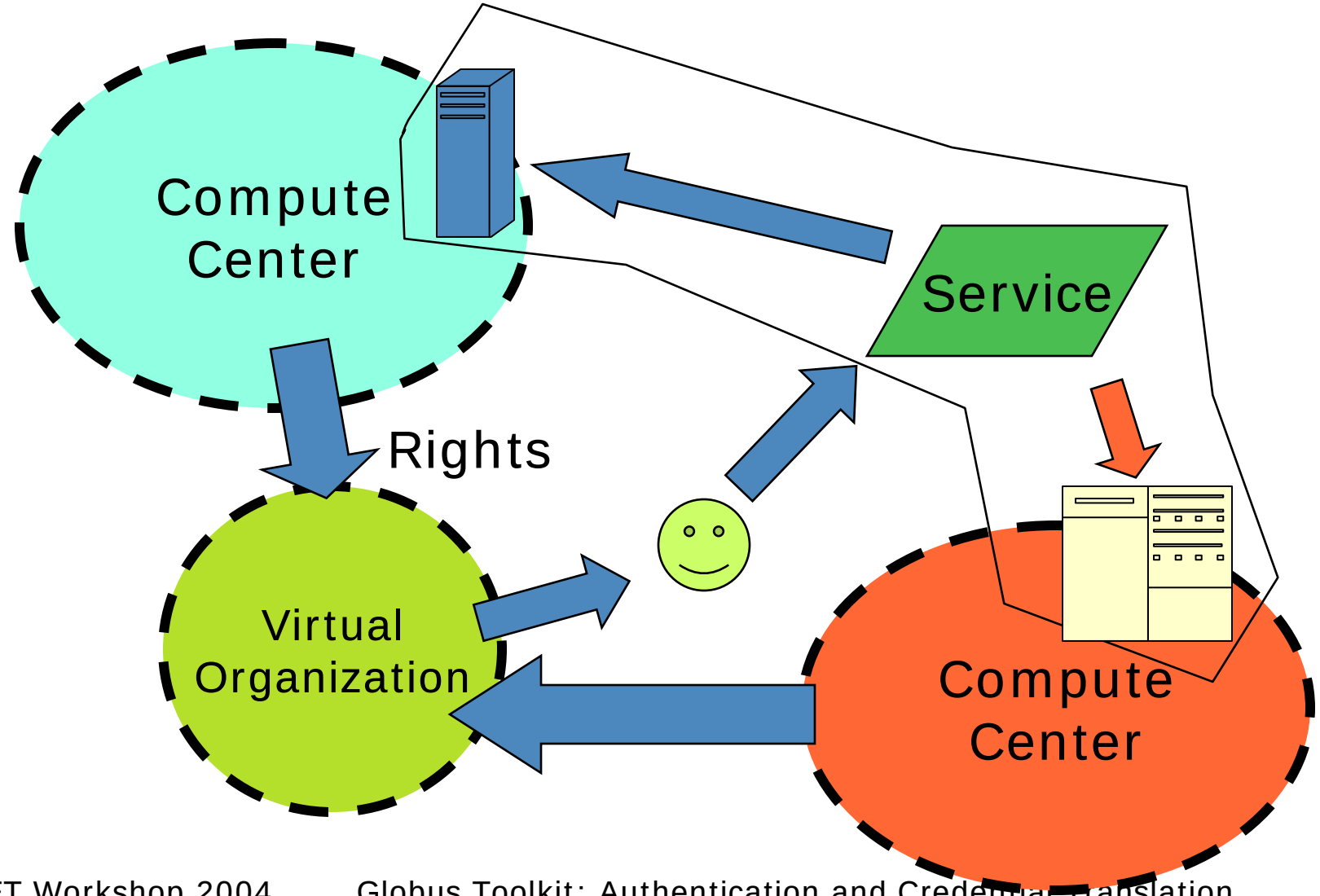


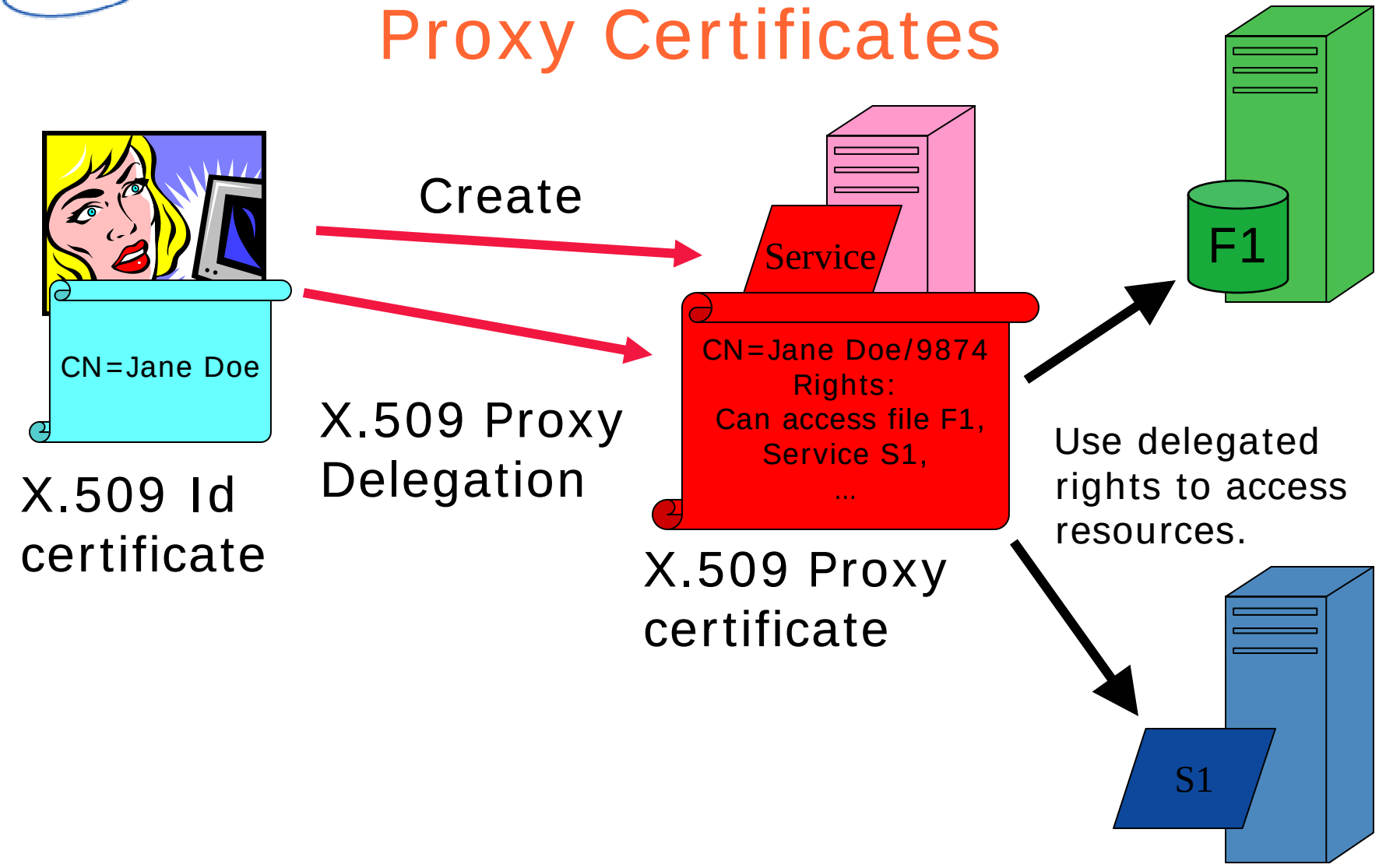
Use Delegation to Establish Dynamic Distributed System



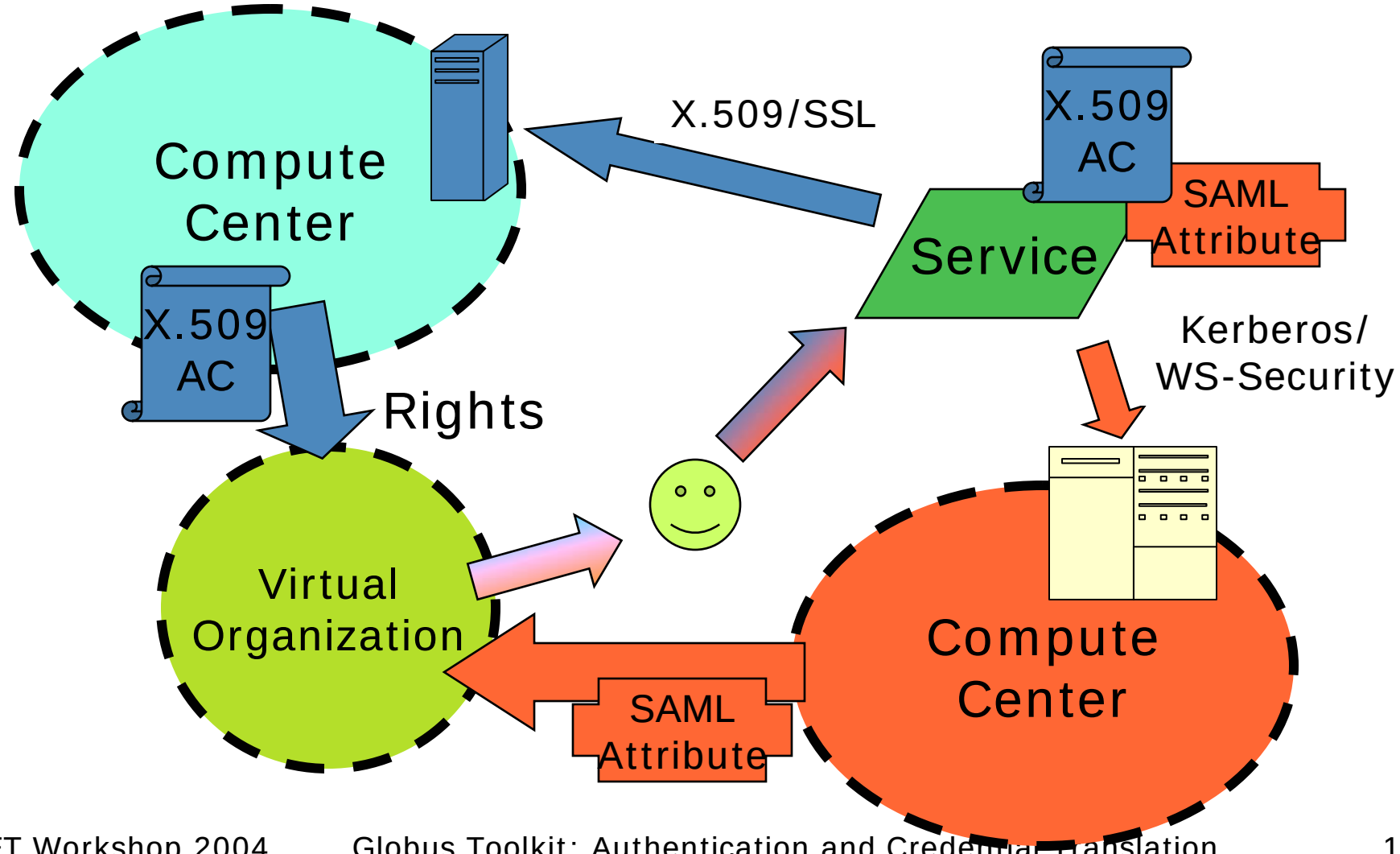
X.509 Proxy Certificates

- GSI Extension to X.509 Identity Certificates
  - On RFC track
- Enables single sign-on
- Allow user to dynamically assign identity and rights to service
  - Can name services created on the fly and give them rights (i.e. set policy)
- What is effectively happening is the user is creating their own trust domain of services
  - Services trust each other with user acting as the trust root

Proxy Certificates



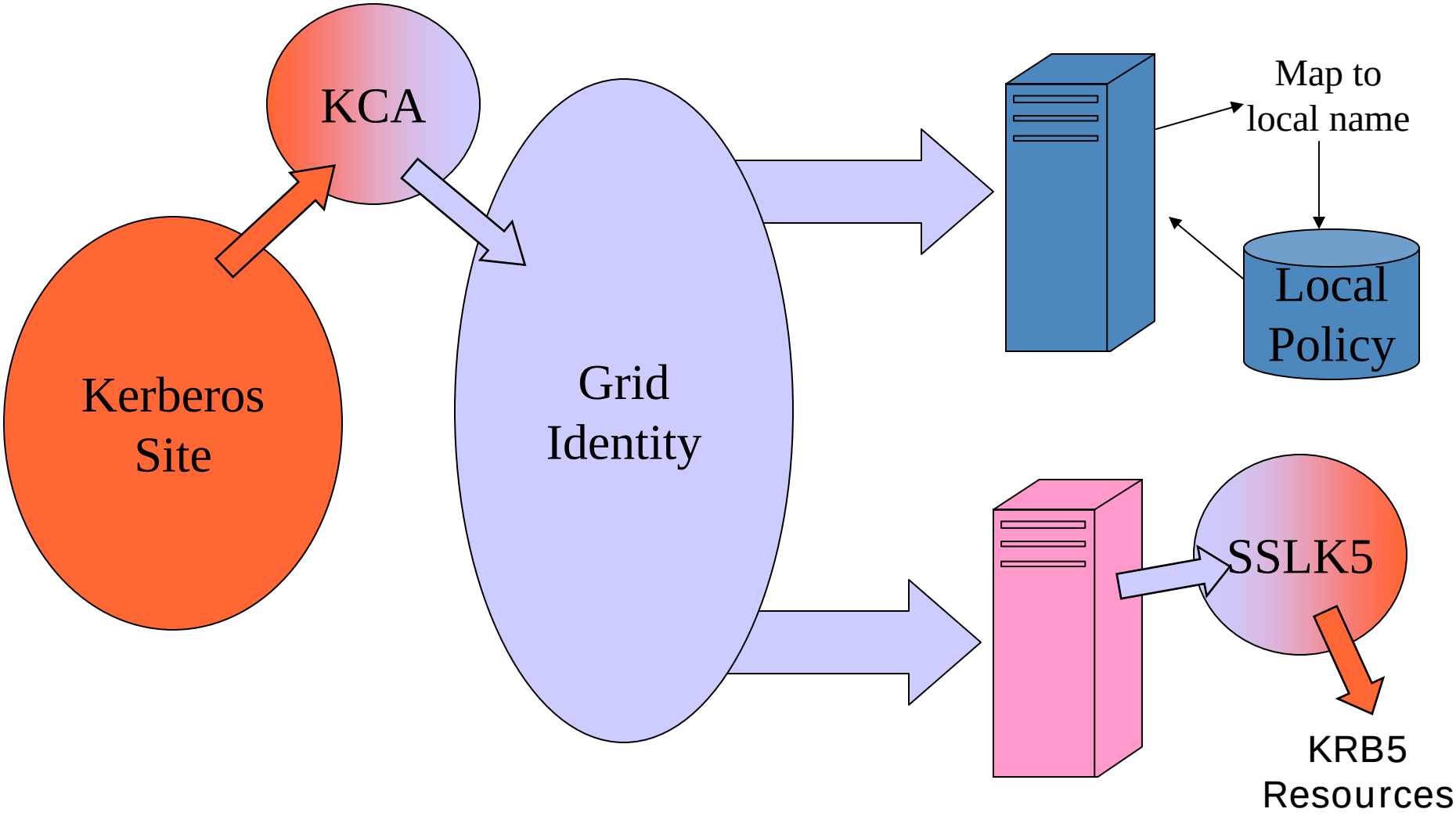
Goal is to do this with arbitrary mechanisms



Kerberos to GSI Gateway

- To use Kerberos, a Kerberos-to-GSI gateway translates Kerberos credentials to GSI credentials to allow local Kerberos users to authenticate on the Grid.
  - Kx509/KCA is an implementation of one such gateway.
- Sslk5/pkinit provide the opposite functionality to gateway incoming Grid credentials to local Kerberos credentials.

Local Identity, Grid Identity, Local Policy



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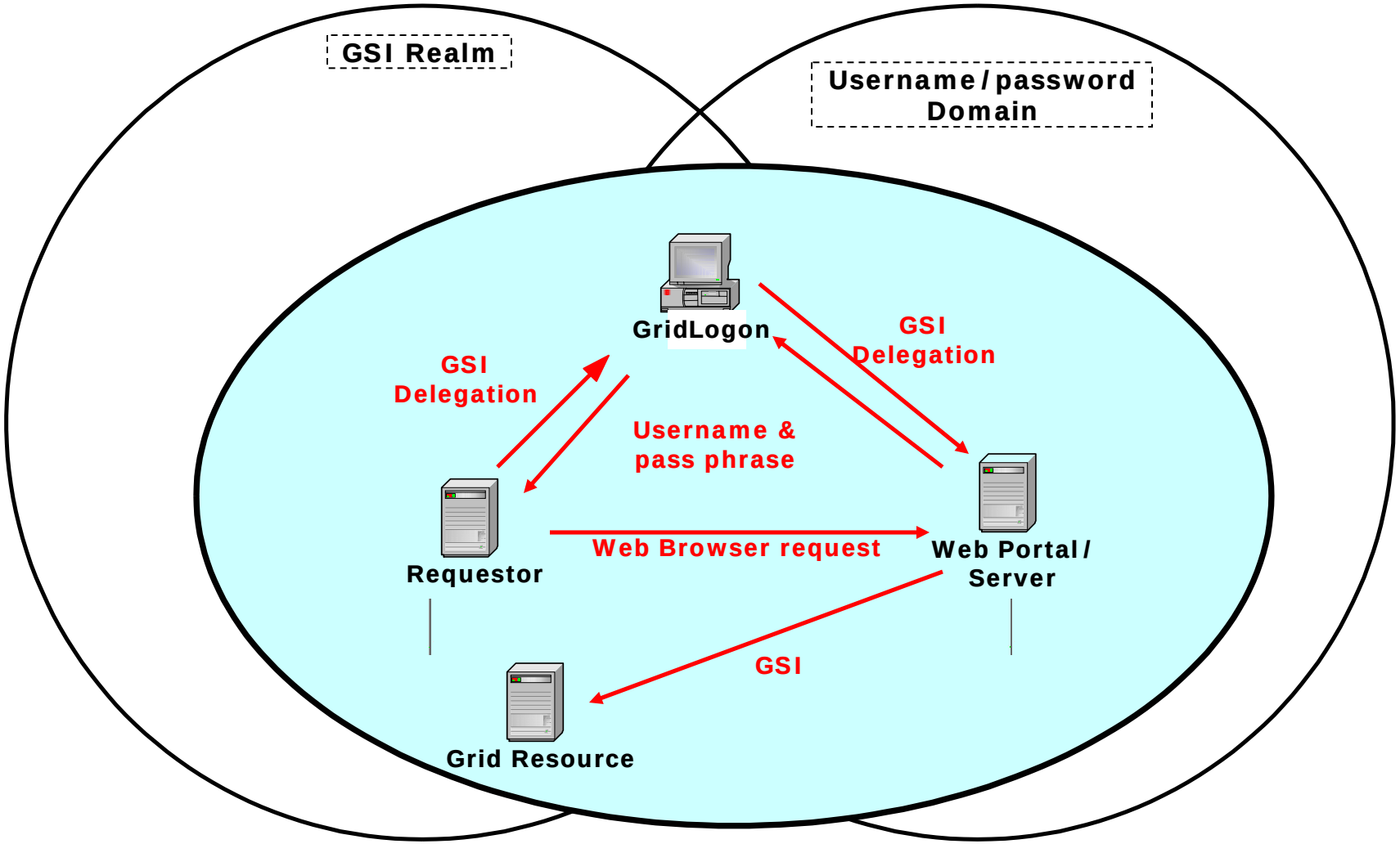
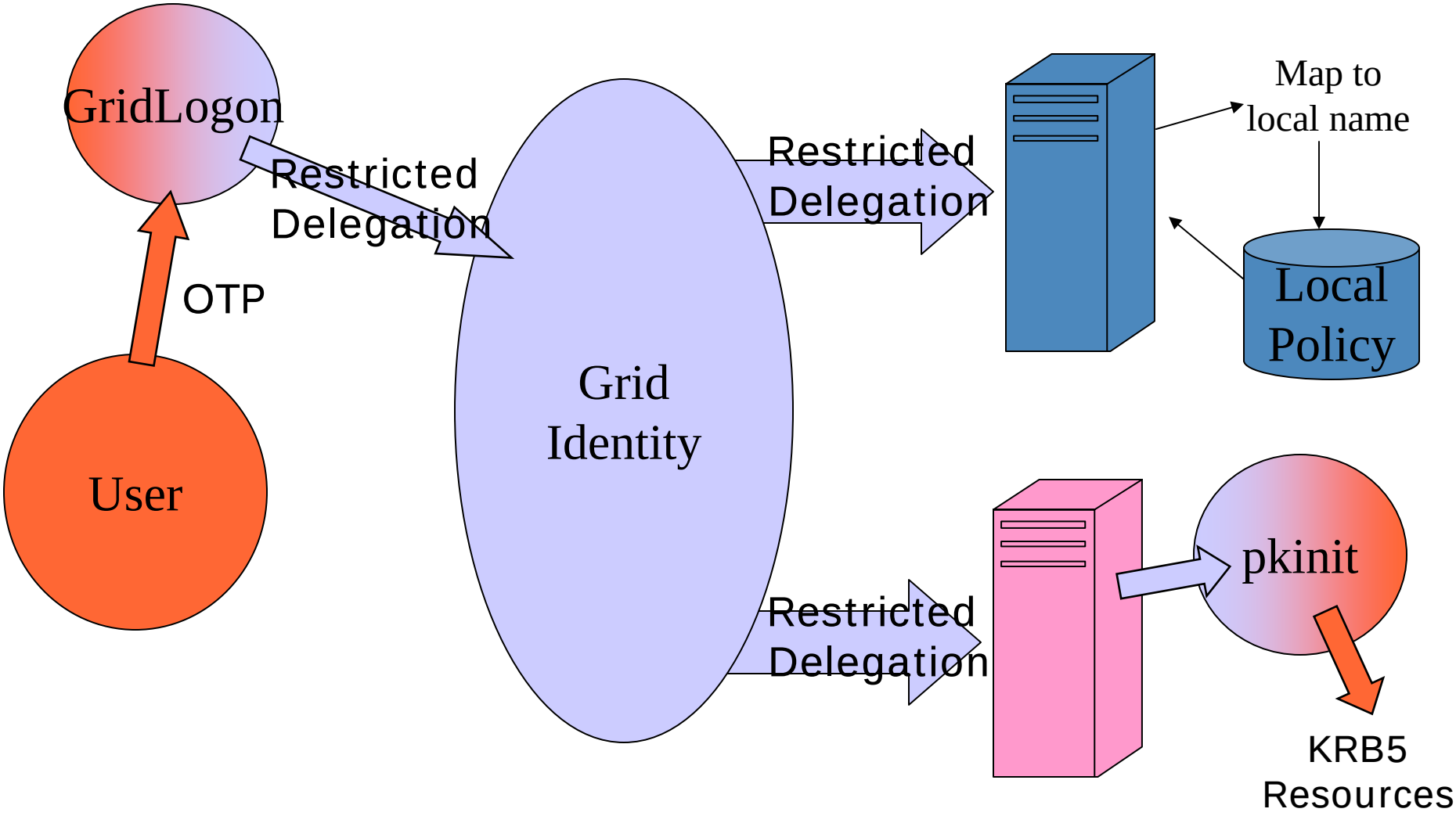
GridLogon: Credential Wallet/Converter

- GridLogon (MyProxy) allows users to store GSI credentials and retrieve them
  - With username/password or other credential
  - Integration with One-Time-Password (OTP) Systems
  - Can act as a credential translator from username/password to GSI
- Used by services that can only handle username and pass phrases to authenticate to Grid
  - Services limited by client implementations
    - E.g. web portals
- Also handle credential renewal for long-running tasks

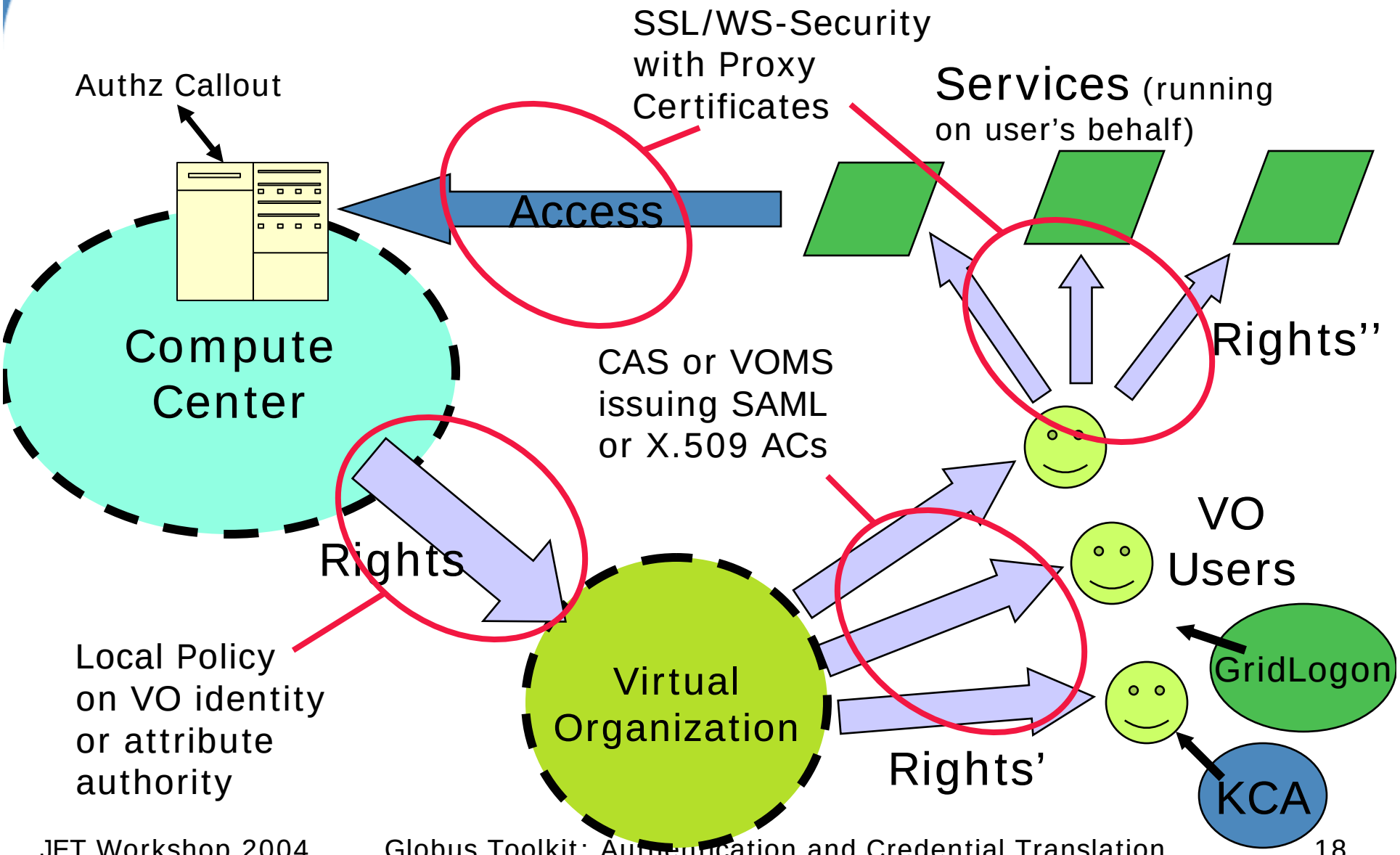
GridLogon: Passphrase-X.509 Federation Service



One Time Passwords and Restricted Delegation



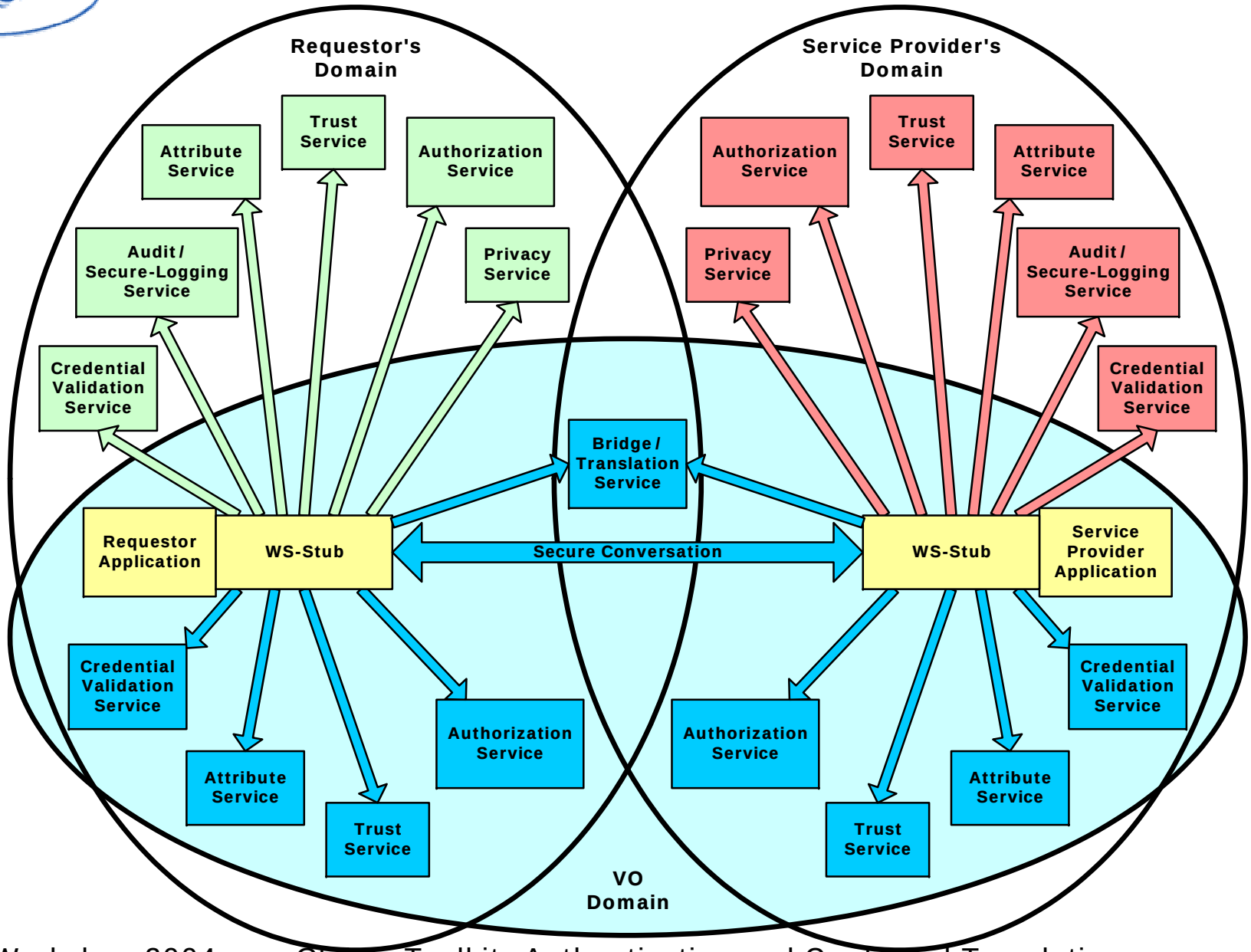
GSI Implementation



Grid Evolution: Open Grid Services Architecture

- Goals
  - Refactor Globus protocol suite to enable common base and expose key capabilities
  - Service orientation to virtualize resources and unify resources/services/information
  - Embrace key Web services technologies for standard IDL, leverage commercial efforts
- Result = standard interfaces & behaviors for distributed system management built on Web services
  - Standardization within Global Grid Forum and OASIS
  - Open source & commercial implementations

OGSA Security Services



Conclusion

- The Globus Toolkit is sophisticated, secure middleware
  - De-facto standard for Grid applications
- Multiple AuthN-mechanism support
  - Plus “translation” services
- Secure Delegation of Rights support
  - through use of proxy-certificate
- Next generation GT based on Web Services
  - Standardized in Global Grid Forum & OASIS
- Globus Toolkit provides a working, evolving implementation for “secure” Grid protocols
  - Downloaded 100k+ times already (www.globus.org)