NG07 summary: Grid state of art, solution, infrastructure, and KnowARC topics

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November 2, 2007

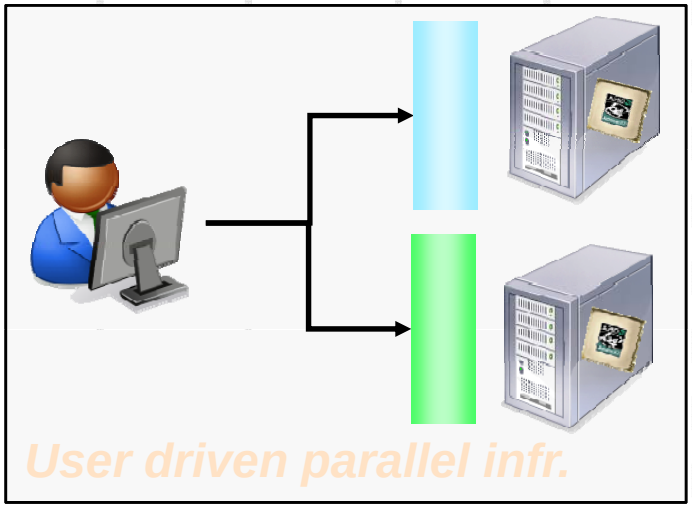
Outline

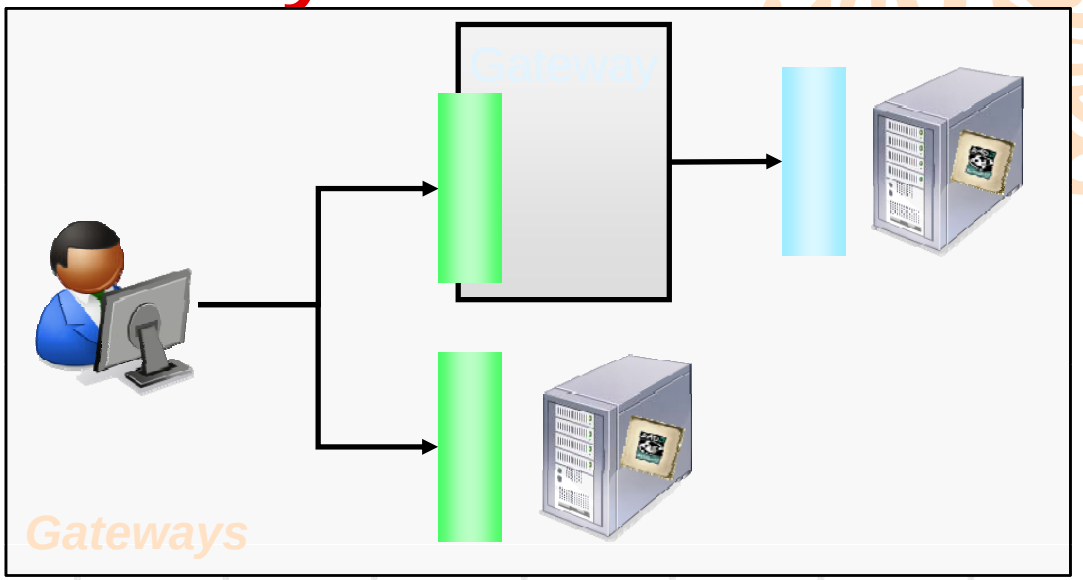
- Grid State of Art
  - Some grid projects and their strategy
- Grid solutions
  - Grid middleware, grid application, grid interoperability
  - Most of them are ARC related
- Grid infrastructures
- Know ARC task/WP meetings, and KnowARC discussion in NorduGrid technical meeting

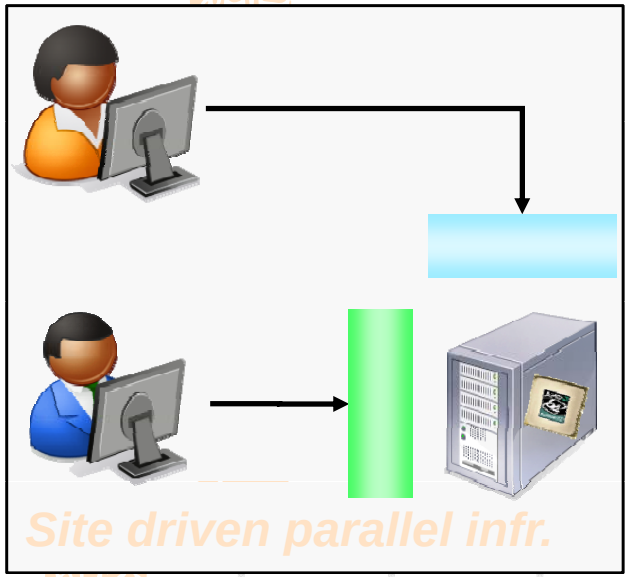
gLite: gLiTe strategy towards standards

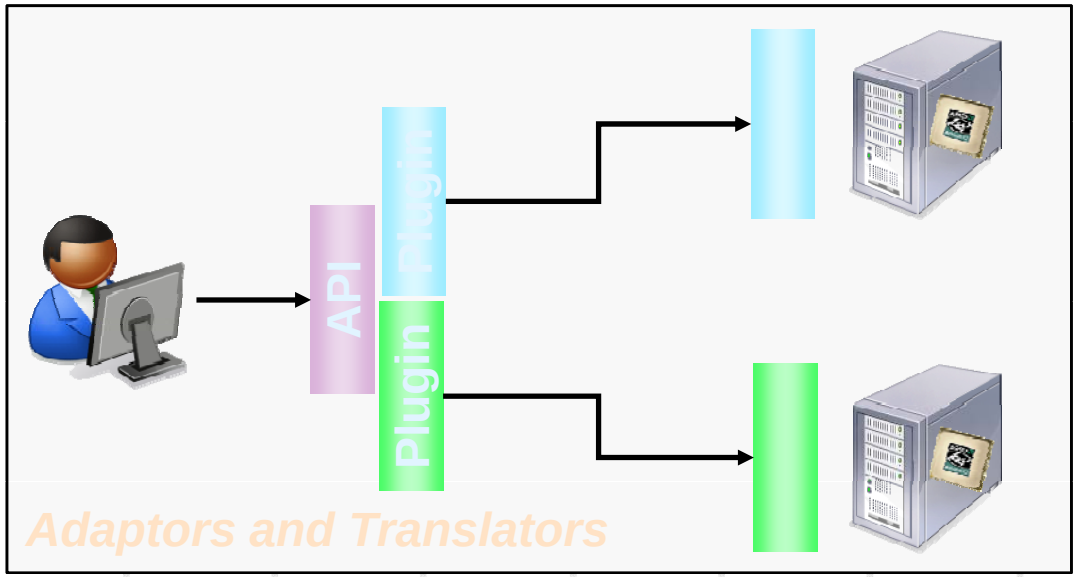
- How to achieve interoperability in absence of adequate standards:
  - Parallel Infrastructures
    - User driven: the user joins different grids (uses different tools)
    - Site driven: the site offers different access methods to resources
  - Gateways
    - Bridges between infrastructures
  - Adaptors and translators
    - Single API for users. Plug-ins provide translation

Interoperability models









gLite: gLiTe strategy towards standards

- What is really relevant for interoperation?
  - Interoperability needs to be provided for Foundation Grid Middleware:
    - Security: Authentication and Authorization
    - Information systems: Information Schema and Service Discovery
    - Data Management: Data Access and Data Transfer
    - Job Management: Job submission and monitoring
  - High Level Services may help building gateways, adapters and translators

gLite: gLiTe strategy towards standards

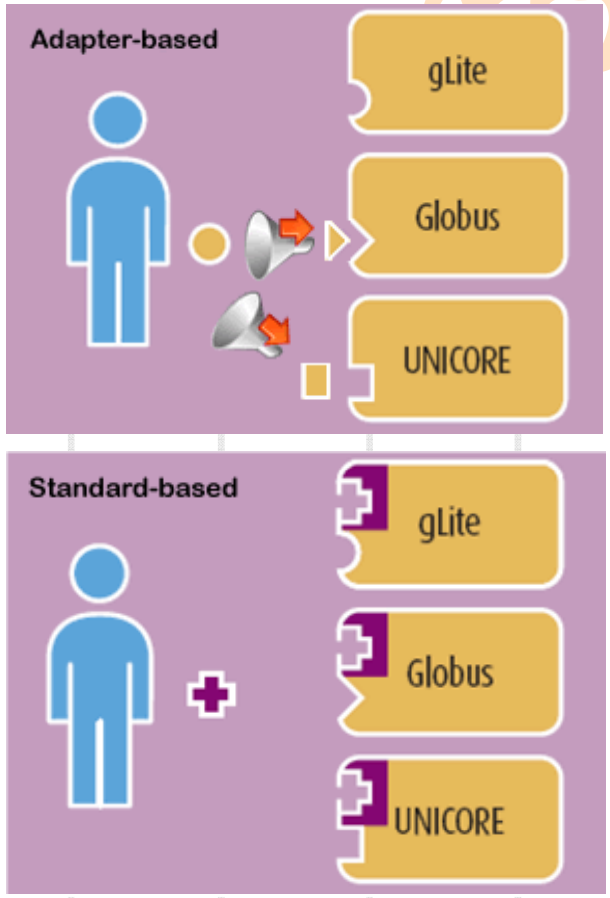
- gLite needs to interoperate with other infrastructures
- Use of standards is the way to go but in the meantime need pragmatic approaches for interoperability
- Focus is on the Grid Foundation middleware
  - Security
    - Certificates for AuthN and VOMS for AuthZ
    - Shibboleth SLCS for short-live certificate
  - Information systems
    - GLUE schema (1.3 now 2.0 in future) and adapters to interoperate
  - Data Management
    - SRM 2.2 interface for data access
    - GridFTP (de-facto standard) for file transfers
  - Job Management
    - CE (Computing Element)
      - **BES** (Basic Execution Service) interface in future (CREAM).
      - Legacy pre-WS GRAM deployed in parallel.
      - gLite WMS, Condor-G and BLAH to build gateways.
    - OGF-UR will be used for accounting

The Contribution of OMII-Europe towards Standard-based Grid Middleware

- Focus
  - Achieving interoperability through common standards
    - Common standards is the long term solution
    - Significant involvement and success in OGF and Oasis
    - Implementations of standards in tandem with standards development on all middleware platforms

Approaches to Interoperability

- Adapters-based:
  - The ability of Grid middlewares to interact via adapters that translate the specific design aspects from one domain to another
- Standard-based:
  - the native ability of Grid middleware to interact directly via well-defined interfaces and common open standards



What OMII-Europe is Doing?

- Initial focus on providing common interfaces and integration of major Grid software infrastructures
- Common interoperable services:
  - Database Access (WS-DAI, WS-DAIX, WS-DAIR (OGSA-DAI))
  - Virtual Organization Management (SAML)
  - Accounting (Usage Record (UR), Resource Usage Service (RUS))
  - Job Submission and Job Monitoring (JSDL, BES)
- Infrastructure integration
  - Initial gLite/UNICORE/Globus interoperability
  - Interoperable security framework
  - Access these infrastructure services through a portal

UNICORE6

- Long history middleware, with friendly user Interface, many application support
- Start to support some standard Web service specifications
- Service Container
  - WSRF 1.2, WS ServiceGroup, WS BaseNotification, WS-I

UNICORE6

- Basic Service
  - UNICORE Atomic Services
    - Target system creation
    - Job submission and job management
    - File system /Storage access
    - File import/export control
  - Registry
    - Publish services (address, service description)
    - Shareable between sites
    - Single Point of entry for clients

UNICORE6

- Security
  - Authentication: X.509 mutual authentication
  - Transport level communication: SSL
  - Message level security information: SAML Assertion
  - Message level communication: digital signed
  - Policy decision in the authorization process: XACML1.0
  - Trust Delegation: SAML trust delegation token

UNICORE6

- File transfer
  - Simple OGSA ByteIO
- Client
  - GPE for UNICORE

XtreemOS: a Grid Operating System providing a native Support to Virtual Organizations

- Design, implementation, evaluation and distribution of an open source Grid operating system
- With native support for virtual organizations (VO)
- And capable of running on a wide range of underlying platforms, from clusters to mobiles.

XtreemOS

- XtreemOS:
  - A new Grid OS, based on the existing general purpose OS Linux
  - A set of system services (extending those found in the traditional Linux) will provide users with all the Grid capabilities associated with current Grid middleware, but fully integrated into the OS
  - The underlying Linux will be extended as needed to support VOs spanning across many machines and to provide appropriate interfaces to the Grid OS services

MIG : Minimum intrusion Grid

- Criticize and rethink the grid solution
- Problems found in the existing models? (not every problem in every middleware)
  - Single point of failure
  - Lack of scheduling
  - Poor scalability
  - No means of implementing privacy
  - No means of utilizing ‘cycle-scavenging’
  - Firewall dependency
  - Highly bloated middleware
  - Many programming languages – few well chosen
  - No economy

MIG

- MiG Rules
  - Nothing produced by MiG can be required to be installed on either the resource or client end
  - Everything within MiG must be implemented in Python unless another language is absolutely required
  - Any design and implementation decision must optimize towards **transparency** for the users
  - Anything that is not right must be thrown away

Open Science Grid

- Concentrate on resource integration, middleware deployment, application support
- OSG Goals – Use of Existing Resources
  - Enable scientists to use and share a greater % of available compute cycles.
  - Help scientists to use distributed systems, storage, processors, and software with less effort.
  - Enable more sharing and reuse of software and reduce duplication of effort through providing effort in integration and extensions.
  - Establish “open-source” community working together to communicate knowledge and experience.

Open Science Grid

- The OSG Facility does :
  - Help sites join the OSG facility and enable effective guaranteed and opportunistic usage of their resources (including data) by remote users
  - Help VOs join the OSG facility and enable effective guaranteed and opportunistic harnessing of remote resources (including data)
  - Define interfaces which people can use.
  - Maintain and supports an integrated software stack that meets the needs of the stakeholders of the OSG consortium
  - Reach out to non-HEP communities to help them use the OSG
  - Train new users, administrators, and software developers

IBM and Grid computing now and in the future

- Span a lot of area, difficult to summarize:
  - Grid and virtualization
  - Grid and Green Computing
  - Grid and data: Challenges at the example of Healthcare
  - provider industry
  - Germany D-Grid
  - "Staged HPC with Grids?"

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- Grid interoperability
  - Glite/ARC interoperability (Gateway method)
  - Interoperability between EGEE, NorduGrid and OSG via Cronus (Virtual Batch System across the grid federations, Adaptor method?)
- Application level middleware
  - LUNARC Application Portal
  - Extending ARC to enable bioinformatics applications (Dynamic runtime environment (RTE) management framework, dynamic installation. Janitor Catalog)
  - Using Taverna as a dynamic RTE within ARC (Open source software tool for designing and executing workflows, used as one use case of Janitor?)

- Grid application
  - Usage of LUNARC portal in bioinformatics (QTL-Analysis)
  - Applications in bioinformatics
  - Computational Biology Enabled by Grid Computing: Application Examples and Lessons Learned from the SwissBioGrid Initiative
  - Bioinformatic applications at NDGF: status and plans
  - Grid-based medical image management
  - ARC and High Energy Physics
  - Experience with ARC usage in computing and education in St.Petersburg

- We had a specific session about KnowARC in “Grid solution” part
  - The HED framework of the new ARC
  - Core services of the new ARC
  - Next generation back-ends
  - Security framework of new ARC
  - Storage System design by KnowARC
    - Propose a new DHT based storage solution

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- M-Grid (The Finnish Material Sciences Grid) (ARC)
- GRID implementation at SiGNET - NDGF-T2 (a testbed, ARC, gLite)
- LitGrid - grid infrastructure for Lithuania (gLite)
- Baltic Grid (base on gLite, with some extension, e.g. Tycoon for distributed resource allocation)
- D-Grid, middlewares and applications (based on Globus, gLite, UNICORE; with a few sub-projects)
- The Norwegian infrastructure for computational science: HPC, storage and grid

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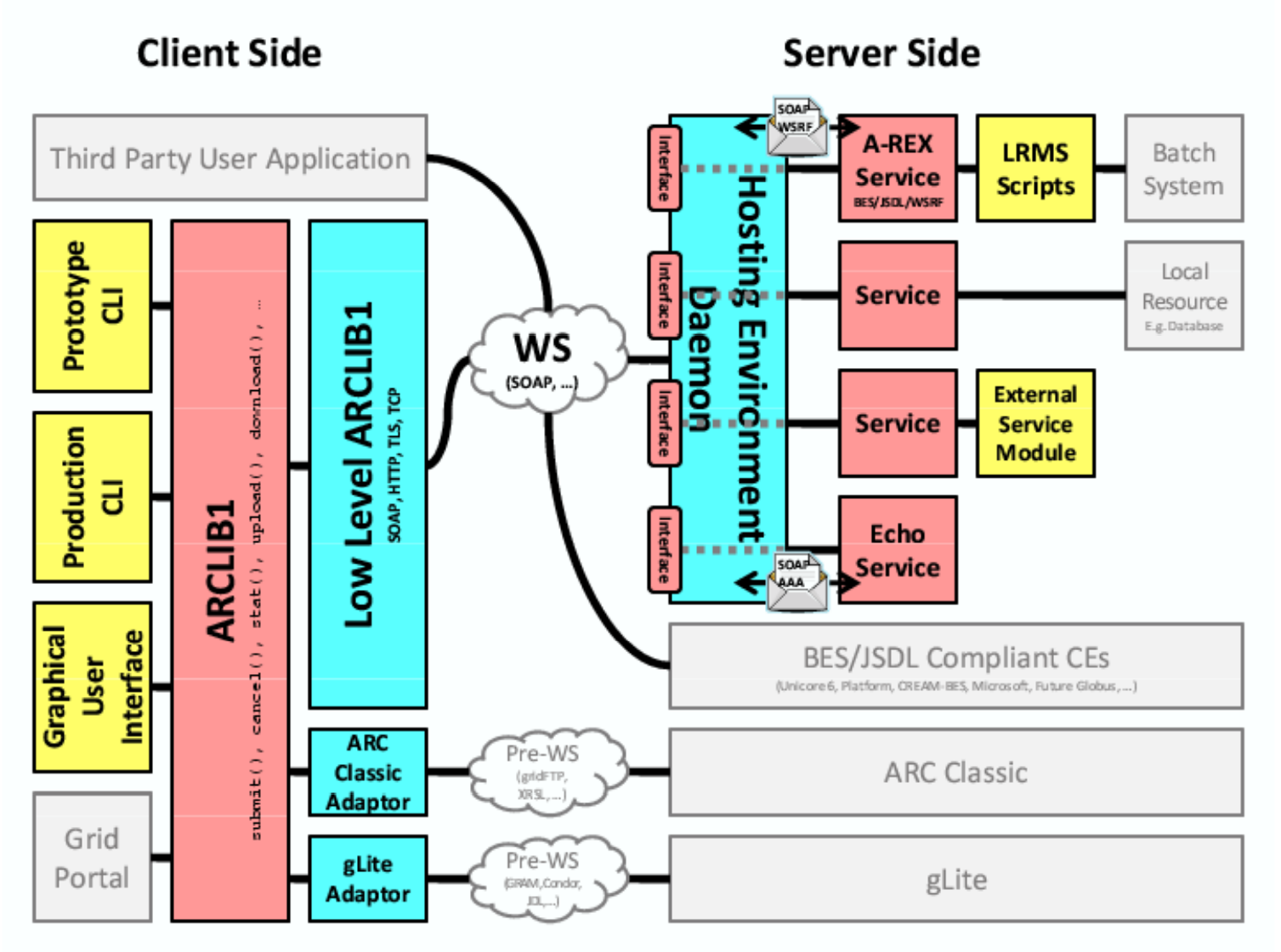
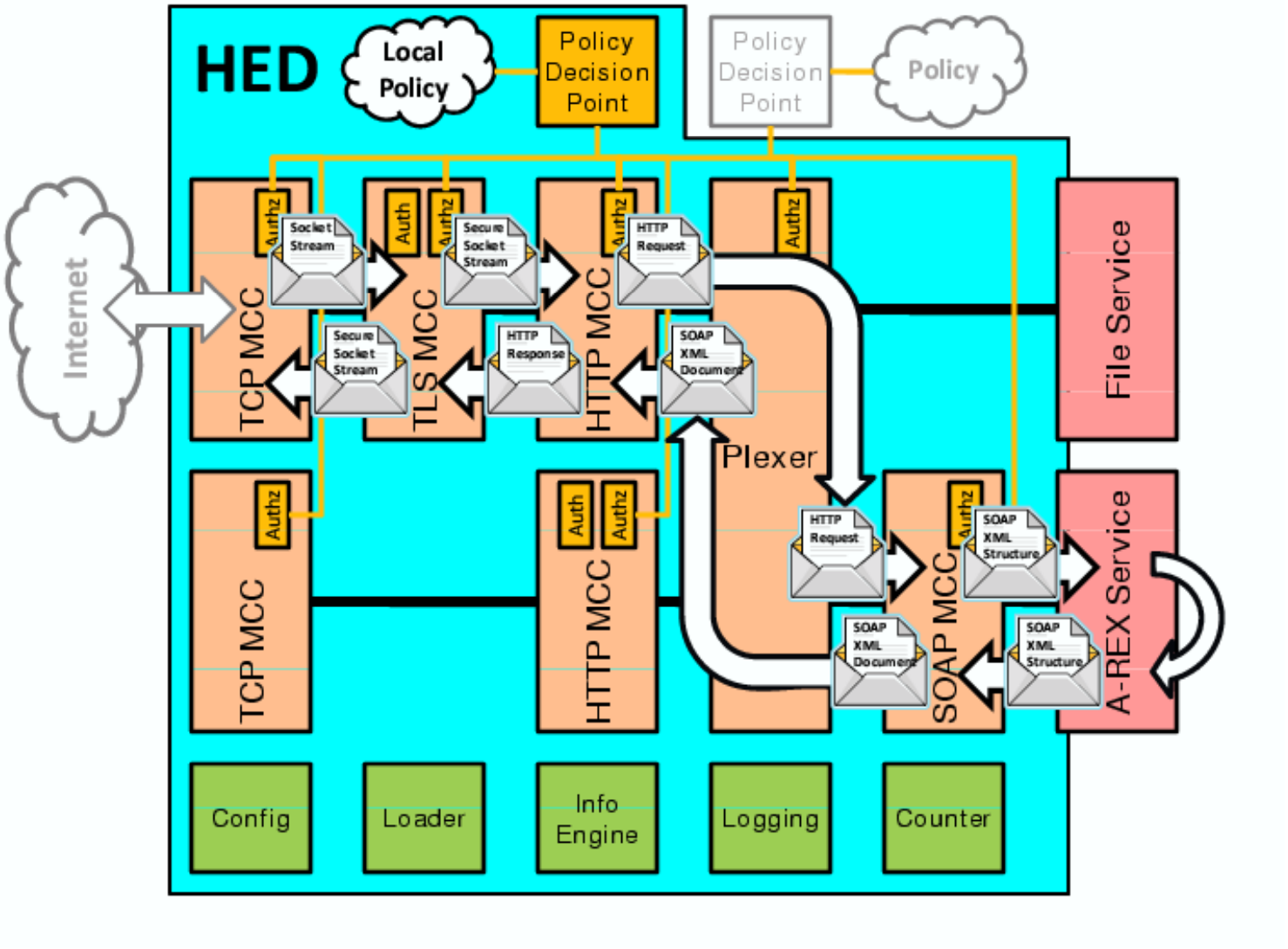
- KnowARC
  - supposed to provide a new generation grid middleware based on ARC
  - to promote standardization and interoperability
  - to support applications in new area


Client Side
Server Side
Third Party User Application
Prototype CLI
Production CLI
Graphical User Interface
Grid Portal
ARCLIB1
submit(), cancel(), stat(), upload(), download(), ...
Low Level ARCLIB1
SOAP, HTTP, TLS, TCP
ARC Classic Adaptor
gLite Adaptor
WS
(SOAP, ...)
Pre-WS
(gridFTP, XRSL, ...)
Pre-WS
(GRAM, Condor, JDL, ...)
Interface
Interface
Interface
Interface
Hosting Environment Daemon
SOAP WSRF
SOAP AAA
A-REX Service
BES/JSDL/WSRF
LRMS Scripts
Batch System
Service
Local Resource
E.g. Database
Service
External Service Module
Echo Service
BES/JSDL Compliant CEs
(Unicore 6, Platform, CREAM-BES, Microsoft, Future Globus, ...)
ARC Classic
gLite


HED
Local Policy
Policy Decision Point
Policy Decision Point
Policy
Internet
TCP MCC
TLS MCC
HTTP MCC
Plexer
File Service
A-REX Service
SOAP MCC
TCP MCC
HTTP MCC
Authz
Auth
Socket Stream
Secure Socket Stream
HTTP Request
HTTP Response
SOAP XML Document
SOAP XML Structure
Config
Loader
Info Engine
Logging
Counter

- What we have now:
  - HED (Web service container, provide SOAP parsing, TLS/SSL, API for Web Service development)
  - Core Services:
    - A-REX (Execution service, Web service on top of Arc0 grid-manager, BES compatible)
    - Echo (test service)
    - Basic information service (Provide Local Information Description Interface)
    - Policy engine (support XML policy; will be extended to XACML standard)
    - Data Storage service (based on functionality of Arc0)
    - Dynamic Runtime Environment, Janitor

KnowARC task/WP meetings

- Presentation and discussion about:
  - KnowARC/ARC1 middleware:
    - Hosting Environment Daemon(HED)
    - Information Indexing Service design (will base on P2P technology and use JXTA)
    - Instant CA service (try to provide convenient certificate for users)
  - Applications:
    - Flowgrid and ARC
    - Medical image management & processing with ARC (based on ARC0)

KnowARC discussion in NorduGrid technical meeting

- The agenda is rescheduled and confusing,
- Presentation and tough discussion
  - Glue 2 (new standard Information schema)
  - Next generation ARCLIB
  - Security framework of new ARC (discussion on the policy engine)
  - Storage system design by KnowARC (discussion on the proposed design)
  - Integrated stagein/out capability of ARC Grid Manager (explanation about the grid manager)
  - Job priorities

- Sandboxing & virtualization (provide virtual-machine based solution)
- HED: performance & ws-compatibility (performance test about ARC0, ARC1)
- Runtime Environments & Application Catalogues
- Security/Taverna integration/Storage (parallel discussion)
- ARC1 Infosys and HED backends