

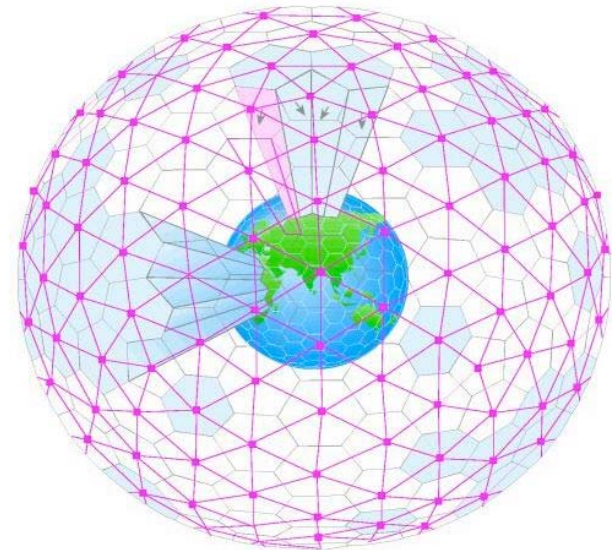
Connected Computing

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Decentralized Computing

- Not just distributed computing
- Decentralization means
 - network services
 - crossing organizational boundaries
 - high latency
- How do we
 - cooperate
 - achieve consensus?



Connected Computing

- Technologies
 - XML
 - Service Oriented Architectures
 - Digital Identity
 - Reputation Systems
 - Directories
 - Resource Discovery
 - Metadata
 - P2P Data Exchange



Resource Discovery

- Problem: build a decentralized resource discovery system (directory)
- Why: self-organizing networks
- Challenges and ideas:
 - Finding the directory
 - Speed
 - Trust
 - Emergent behavior



Distributed Architectures

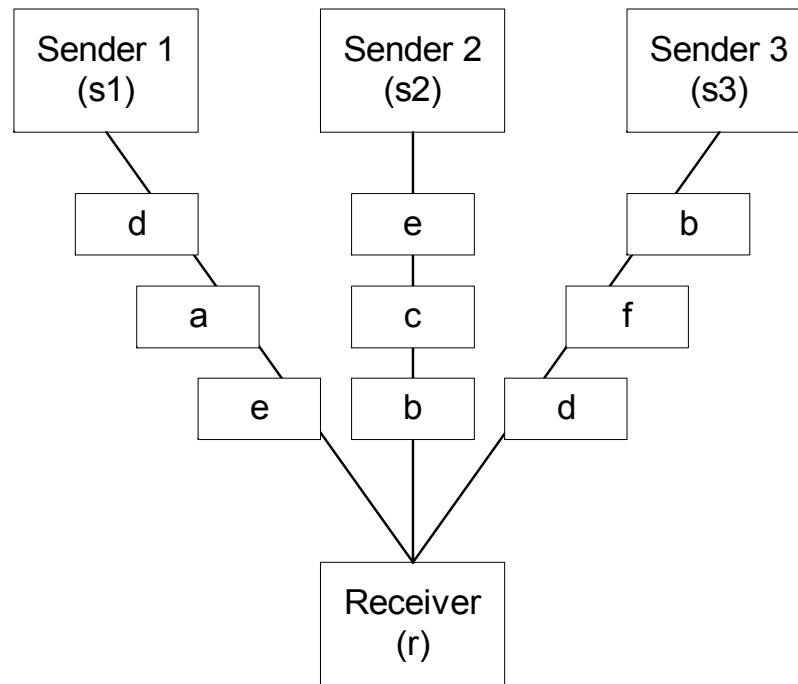
- Problem: insufficient understanding of distributed and decentralized architectures
- Why: Better choices for a given application
- Challenges and ideas:
 - Research and describe architectures
 - Understand pros and cons
 - Document and give case studies
 - What combination of centralization and decentralization works best for a particular application and information architecture?

Information Additive Codecs

- Linear equations as an abstraction
- a) $X + Y = 5$ d) $X - Y = 1$
b) $X + Z = 4$ e) $X - Z = 2$
c) $Y + Z = 3$ f) $Y - Z = 1$
- Not all six equations are required, any three will do
- IACs work the same way
 - Multiple streams of data
 - Grabbing some yields all data
 - Repeating streams

IAC Properties

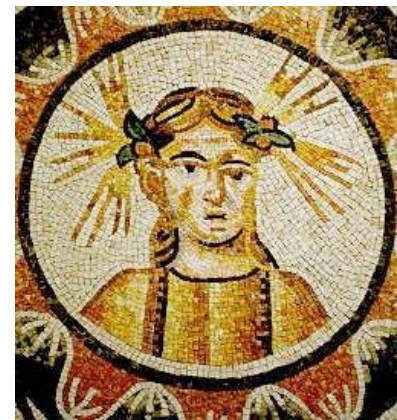
- Multiple streams received simultaneously



- P2P is a natural transport scheme for IACs

Byzantine Tolerant IACs

- Problem: distributed data exchange with fault tolerance in the face of malicious actors
- Why: data exchange can be compromised
- Challenges and ideas:
 - Applying Byzantine-defeating strategies to IACs
 - Discovery
 - Reputation
 - P2P exchange



IAC Back-up

- Problem: use IAC techniques to create self-organizing P2P back-up facility
- Why: organizations have lots of underutilized DAD storage that isn't backed-up
- Challenges:
 - Resource discovery
 - Fault tolerance
 - Resource virtualization



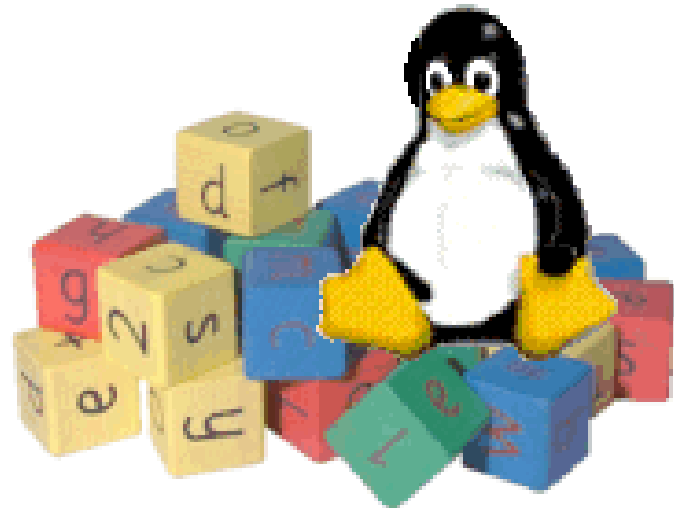
We need **BACKUP!**

Web Services OS

- Problem: Create basic OS-like services as network services (think libc for WS)
- Why: Web services need consistent, building-block services as components
- Challenges:
 - What are the right blocks?
 - How do they work as a network service?
 - What is the effect of document centrality?
 - Job control and scheduling

Example Services

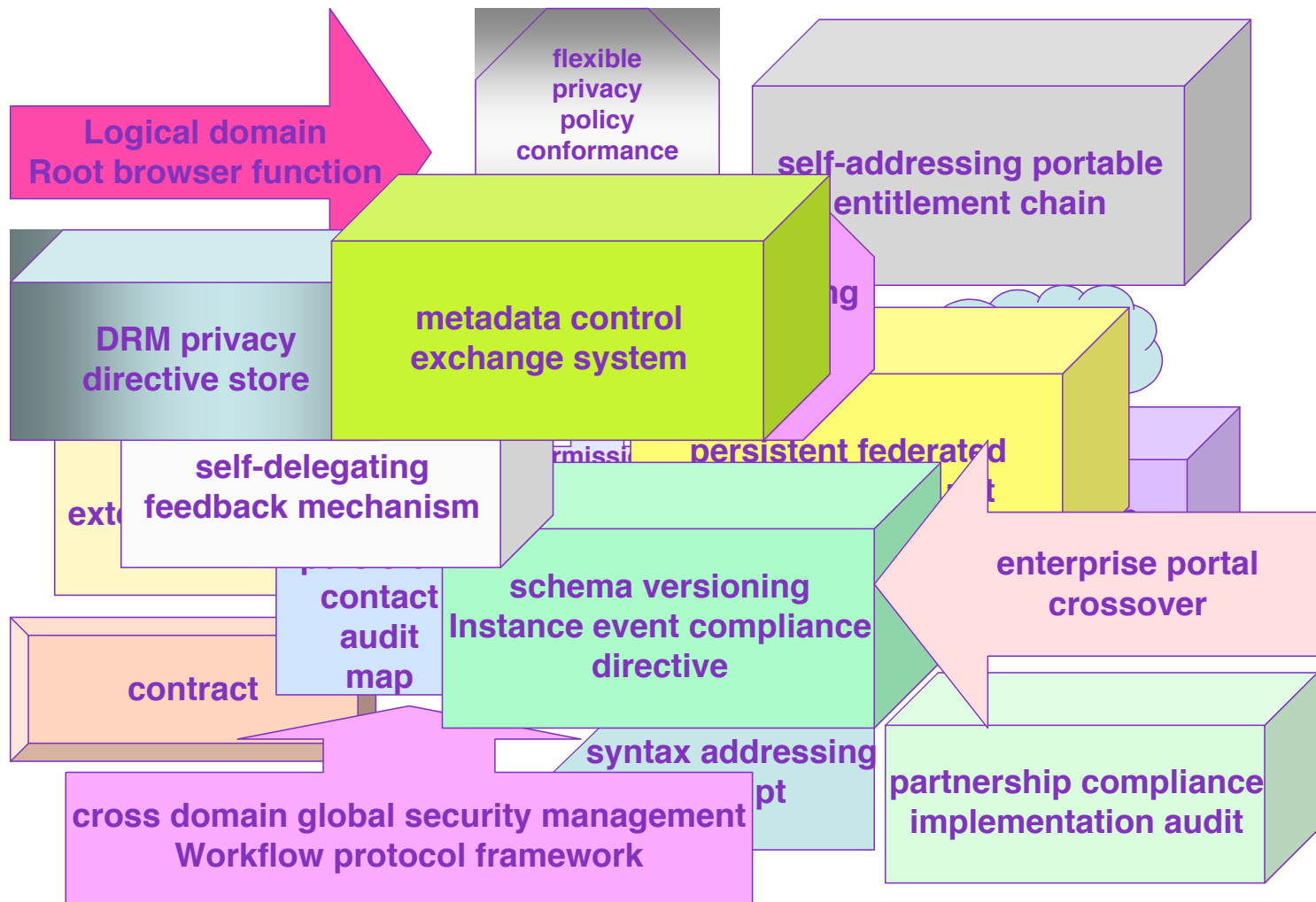
- Timestamp service
- Cronjob service
- PayMe transaction service
- Use XML appliances



Authorization

- Problem: Create new tools for managing identity information
- Why: workflow, diagnostics, and provisioning workload related to identity information keeps it from being widely used
- Challenges:
 - What general purpose abstractions help with diagnosing authentication problems?
 - Are there generic workflow models that can be easily specialized to multiple problems?

Identity Infrastructures



Architecture courtesy of Doc Searls

Identity System Architectures

- Problem: Characterize and analyze real-world identity infrastructures
- Why: Complex systems comprising directories, authorizations engines, etc. have grown up ad hoc
- Challenges:
 - Identity systems are a complex grid
 - Components span from presentation to persistence
 - Identity middleware at Internet2

Content Pipelines

- Problem: Annotate RSS and OPML with outside information
- Why: Information streams can pick up useful links as they flow to the user
- Challenges and ideas:
 - Filtering
 - Flagging
 - Annotating
 - Translating
 - Reputation
 - RSS as an event system



eGovernment

- Problem: work with agencies to build low-cost, interoperable systems
- Why: 20,000 state and local governments responsible for Homeland Security, etc.
- Challenges:
 - Multiple owners
 - Latency
 - Sophistication gap
 - Legacy systems



eGovernment Examples

- Notification system that handles multiple XML formats and is personalizable
- Cowster for tracking livestock
- NSF program for eGovernment



Decentralized Assertions

- Problem: Generalized distributed reputation systems
- Why: Many identity applications
- Challenges:
 - Use RDF tuples to store assertions (Semantic Web)
 - Use modified trackback mechanism (with identity token image)
 - User views based on their trust network
 - Technorati as an example

Contact Info

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Questions?

