



Finding and Supporting Collaboration Needs and Opportunities

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Evolution of Collaboration



- Distributed Collaboratory Experiment Environments
 - Remote access to instruments – ALS, EM, NMR, Tokamak
 - Technology development – electronic notebooks, security, multicast, etc
- DOE 2000
 - Technology development – communication, security, shared spaces, logbooks, etc
 - Collaboratory pilots – On-line instruments (MMC) and Shared resources (DCC)
- National Collaboratories Program
 - Technology development – distributed computing, security, collaborative tools, portals, web services, data management, etc
 - Collaboratory pilots – PPDG, ESG, NFC, and CMSC
 - Partnering among agencies
- Science of Collaboratories Program
- Broad range of efforts integrated with science areas



Collaboration Modes



- Synchronous/Meetings
 - Seminar
 - Tutorial
 - Presentation
 - Working group
 - Brainstorming
- Asynchronous/Shared work products
 - Document editing
 - Code development
 - Shared data
 - Web portal
 - Workflow
- Semi-synchronous
 - Chat/presence
 - Shared web spaces
 - Video streaming and recording
 - E-mail, blogs, etc



Evolving Collaborative Tools



- Telepresence
 - H.323
 - EVO/VRVS
 - Access Grid
 - Skype
 - Many commercial solutions
 - ...
- Shared Workspaces
 - Wiki
 - Indico (CERN)
 - Sakai Project
 - Microsoft's Sharepoint
 -
- News updates
 - Blog
 - RSS feeds
 - Digital Video Transport System (DVTS)
 - ...



Primary Drivers



- Collaboration takes effort and thus must
 - Provide a perceptible benefit to all participants
 - Fit with work needs
 - Be easily accessible to the users (particularly new users)
 - Have a very low failure rate
 - Be institutionally supported
 - Be a separately funded effort if it is to have strong support
- Group must have a strong need to collaborate and the collaboration tools must provide a significant improvement compared to current practice
- Support for asynchronous interaction important
- Difficult to predict how a technology will or will not be used by a particular group
- Collaboration technology also creates new paradigms of interaction
- Sociology is a dominant factor



Things to consider



- Time zone variation
 - Record content for later playback and search
 - Pre-recorded content for inclusion in a discussion
- Late adopters
 - Equipment, knowledge and support
 - Some people will be difficult to move to collaborative tools
 - Some people will already be using a different tool
- Killer content
 - Contains content that brings late adopters to the system
 - Definitive place to find other collaborators
- Interfaces
 - Local and remote interfaces should not necessarily be the same
 - Needs to be valuable to local site if they need to run it
- Scalability
 - 1000's of users demands advanced dissemination architecture
- Cybersecurity
 - Avoid disruption of the meeting and parasitic content
 - Disallow spammers and hackers
 - Security appropriate to content and features



Cybersecurity



- Collaborative tools are developed independent of operational cybersecurity considerations
 - Implications of site mechanisms
 - Protections from malicious code
 - Vulnerability testing
 - Interoperability with site cybersecurity mechanisms
- Spammers and hackers will attack the infrastructure
 - Self-register to introduce content and advertisements
- Protect environment while allowing easy access to authorized users
- Allow occasional users to easily participate
- Enable users (denial of legitimate service extremely rare)
- Rapid entry for legitimate users



Threats



- Viruses
- Worms
- Malicious software downloads
- Spyware
- Stolen credentials
- Insider Threat
- Denial of service
- Root kits
- Session hijacking
- Agent hijacking
- Man-in-the-middle
- Network spoofing
- Back doors
- Exploitation of buffer overflows and other software flaws
- Phishing
- Audits / Policy / Compliance
- ?????



Example - Credential Theft



- Widespread compromises
 - Over 20++ sites
 - Over 3000+ computers
 - Unknown # of accounts
 - Very similar to unresolved compromises from 2003
- Common Modus Operandi
 - Acquire legitimate username/password via keyboard sniffers and/or trojaned clients and servers
 - Log into system as legitimate user and do reconnaissance
 - Use “off the shelf” rootkits to acquire root
 - Install sniffers and compromise services, modify ssh-keys
 - Leverage data gathered to move to next system
- ***The largest compromises in recent memory (in terms of # hosts and sites)***



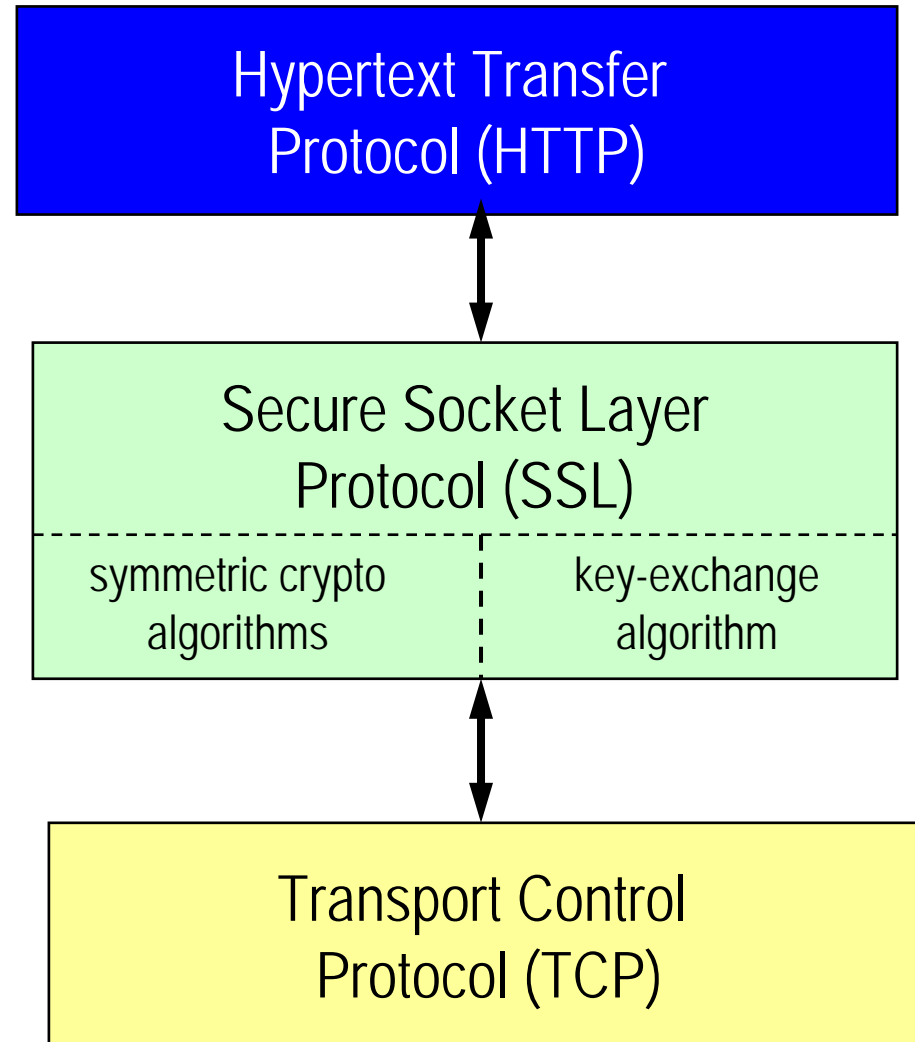
Secure Group Communication



- An increasing number of distributed applications need to communicate within groups, e.g.
 - collaboration and videoconferencing tools (Access Grid)
 - distributed computations (Computational Grid)
 - replicated servers
 - distributed applications
- An increasing number of distributed applications have security requirements
 - privacy of data
 - protection from hackers
 - protection from viruses and trojan horses

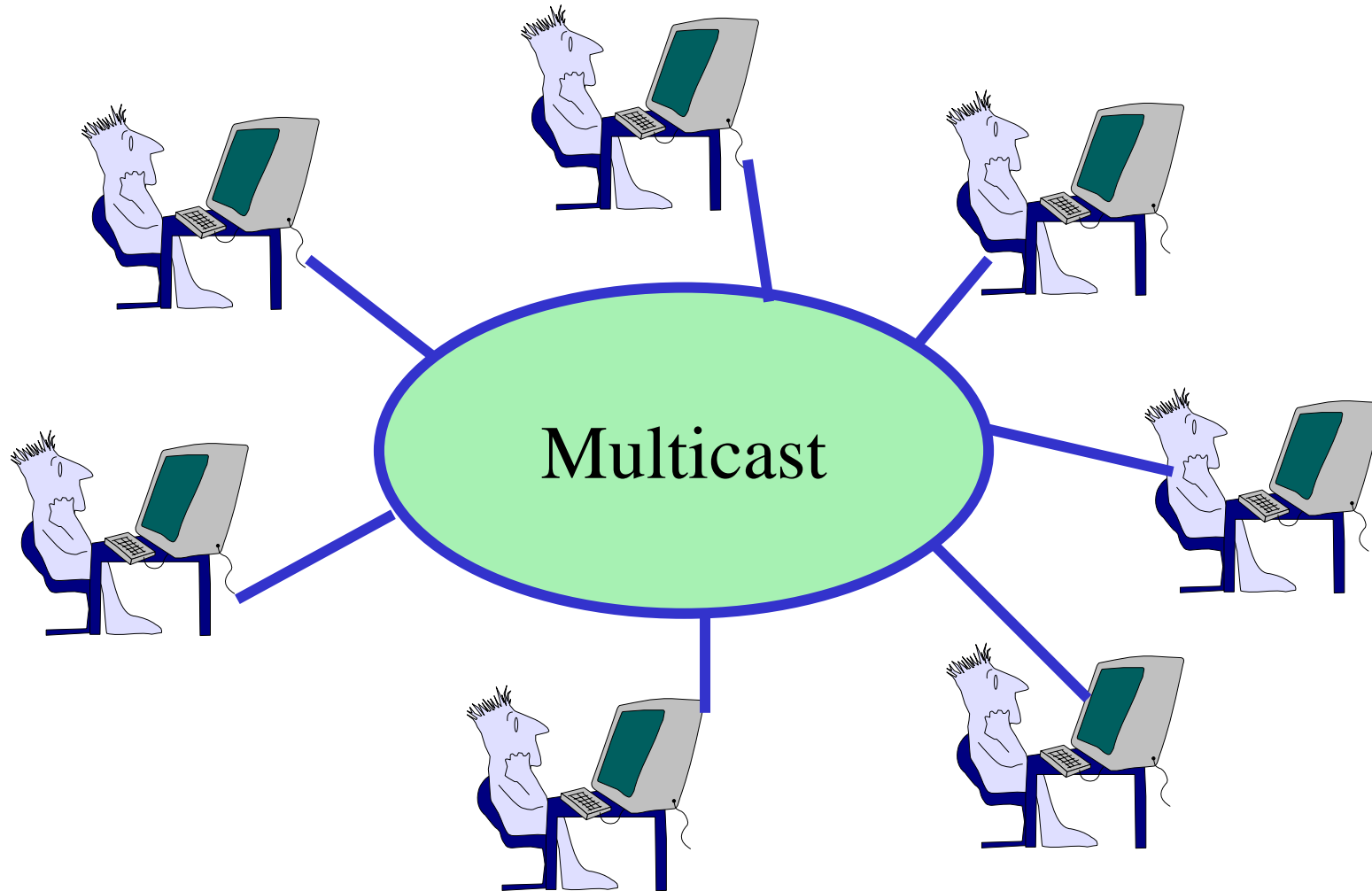


Reliable and Secure Unicast Communication : Architecture



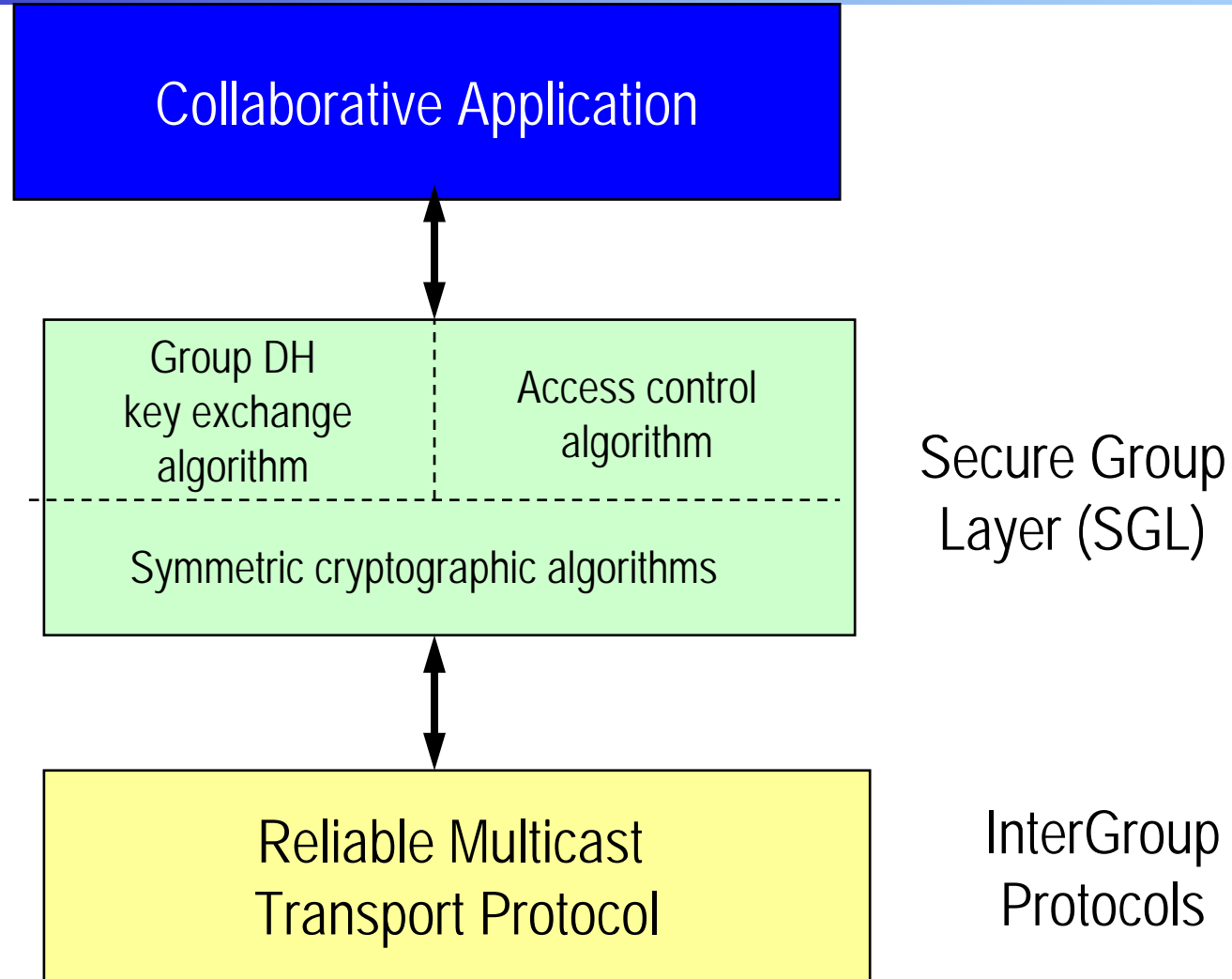


Group Communication





Reliable and Secure Multicast Communication : Architecture

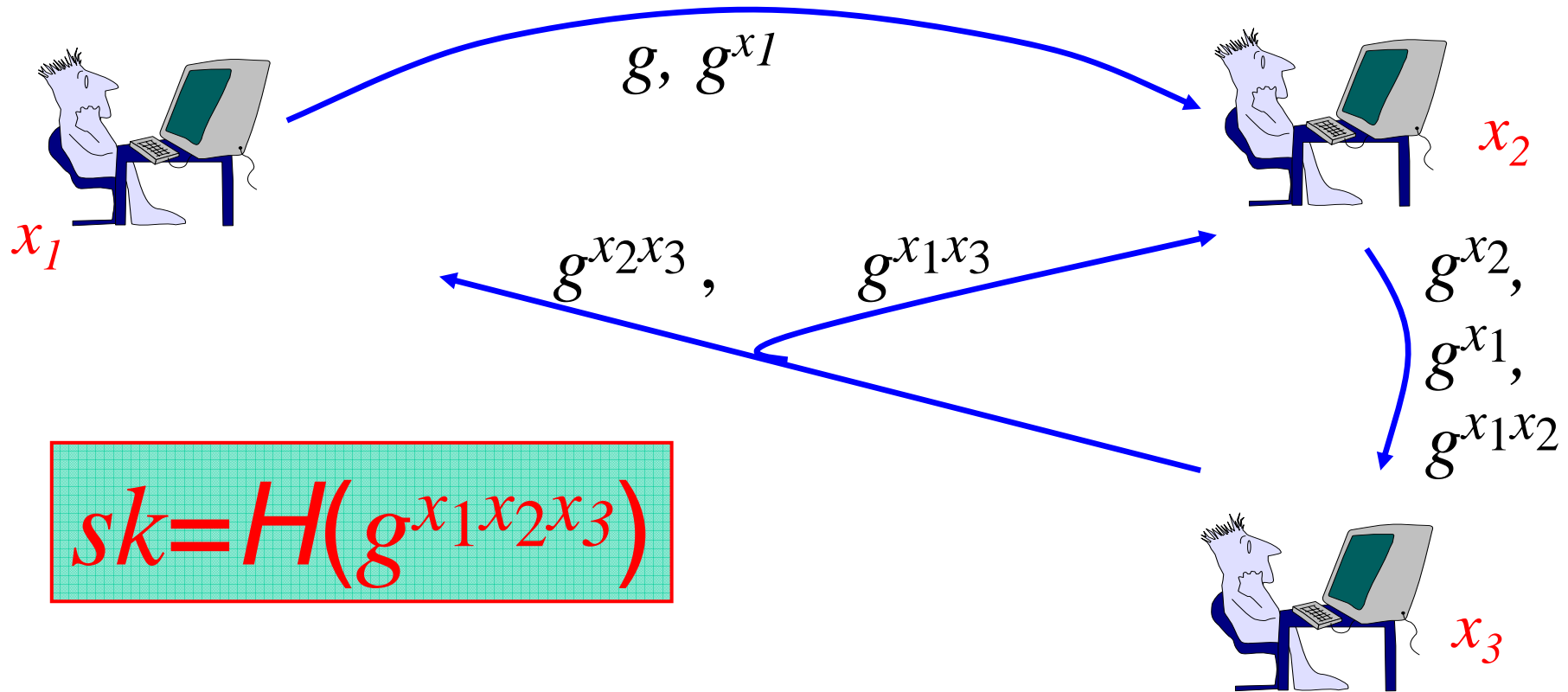




Authenticated Group DH Key Exchange



- Up-flow: U_i raises received values to the power of x_i and forwards to U_{i+1}
- Down-flow: U_n processes the last up-flow and broadcasts





Collaboration Tools and Cybersecurity



- Collaborative tools building trust relationships across sites
- Extensive cross-site communication
- Many ports and protocols employed – high bandwidth
- Encrypted connections
- Multicast traffic difficult to police
- Servers need to be able to allow incoming connections
- Need to design cybersecurity considerations and coordination into the next generation of collaborative tools



Key Points



- Provide killer content
- Support asynchronous interaction
- Make it easy to use and particularly begin to use
- Trust in the system as a primary interaction mode is important
- Cybersecurity will be important to protect content integrity and control access
- Finding the right point of the technology curve is difficult
- Sociology will dominate adoption and should be a serious consideration of design