# The Columbia University SIP Suite: CINEMA

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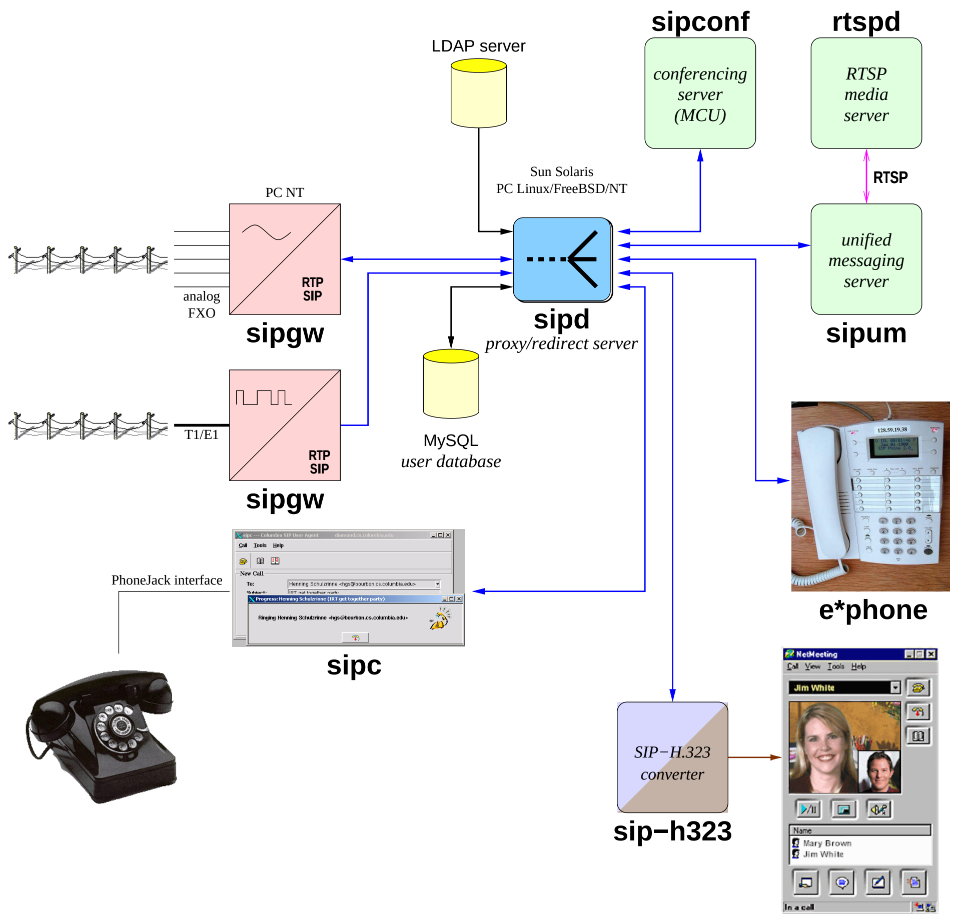
# Overview

- architecture
- SIP library: C/C++ and Java
- SIP clients
- SIP proxy/redirect/application server
- SIP applications: unified messaging, conferencing
- related work: QoS, charging, mobility, 911 services

# Goals

- commercial-grade, but simple implementations
- standards-compliant:
  - SIP (RFC 2543 and some extensions)
  - Call Processing Language (CPL)
  - sip-cgi
- cross-platform:
  - Unix: Solaris, Linux, FreeBSD, True64, ...
  - Windows 98, NT and 2000
- use open-source components where feasible:
  - mySQL for SQL database (user configuration)
  - OpenLDAP

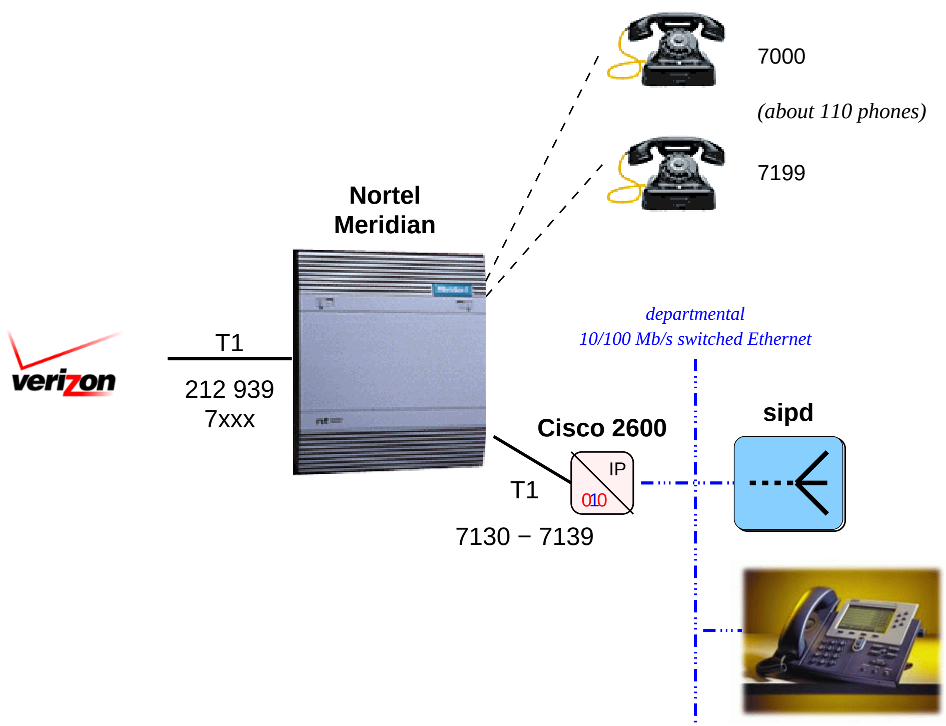
# Overall architecture




common code base for everything except sipc and e*phone

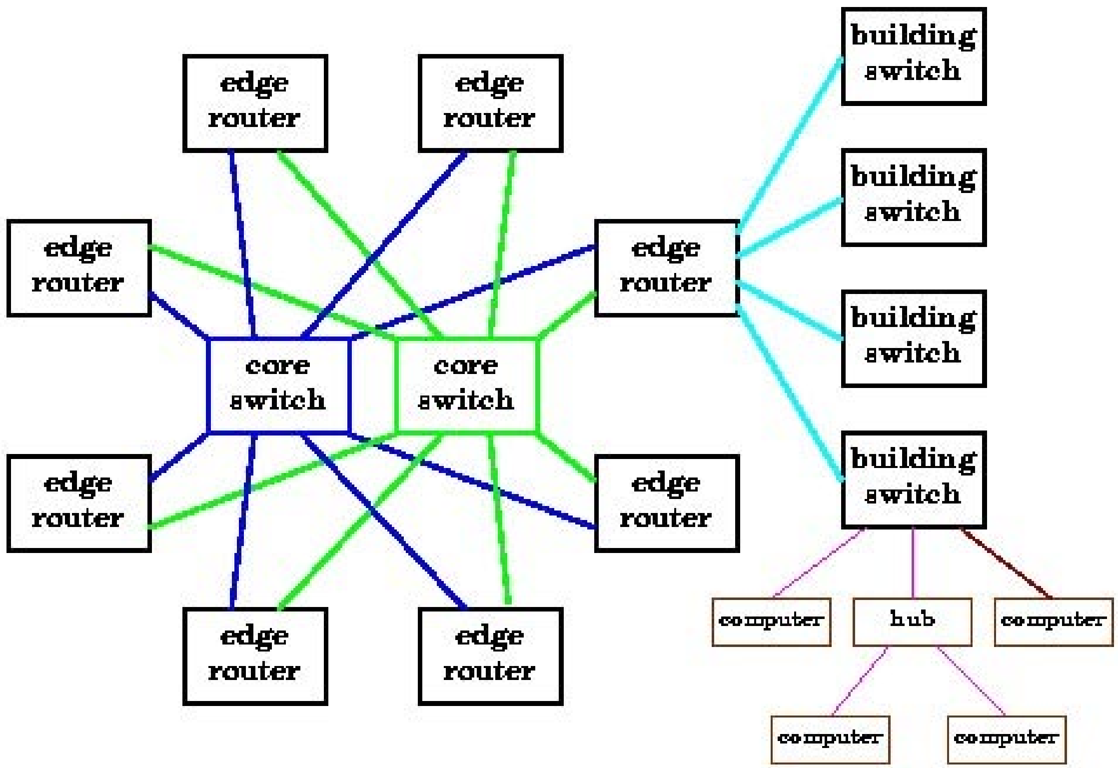
# Columbia University Computer Science test bed

- Columbia CS runs its own PBX (15-year old Nortel Meridian)
- allow both intra-department and external in/out calls



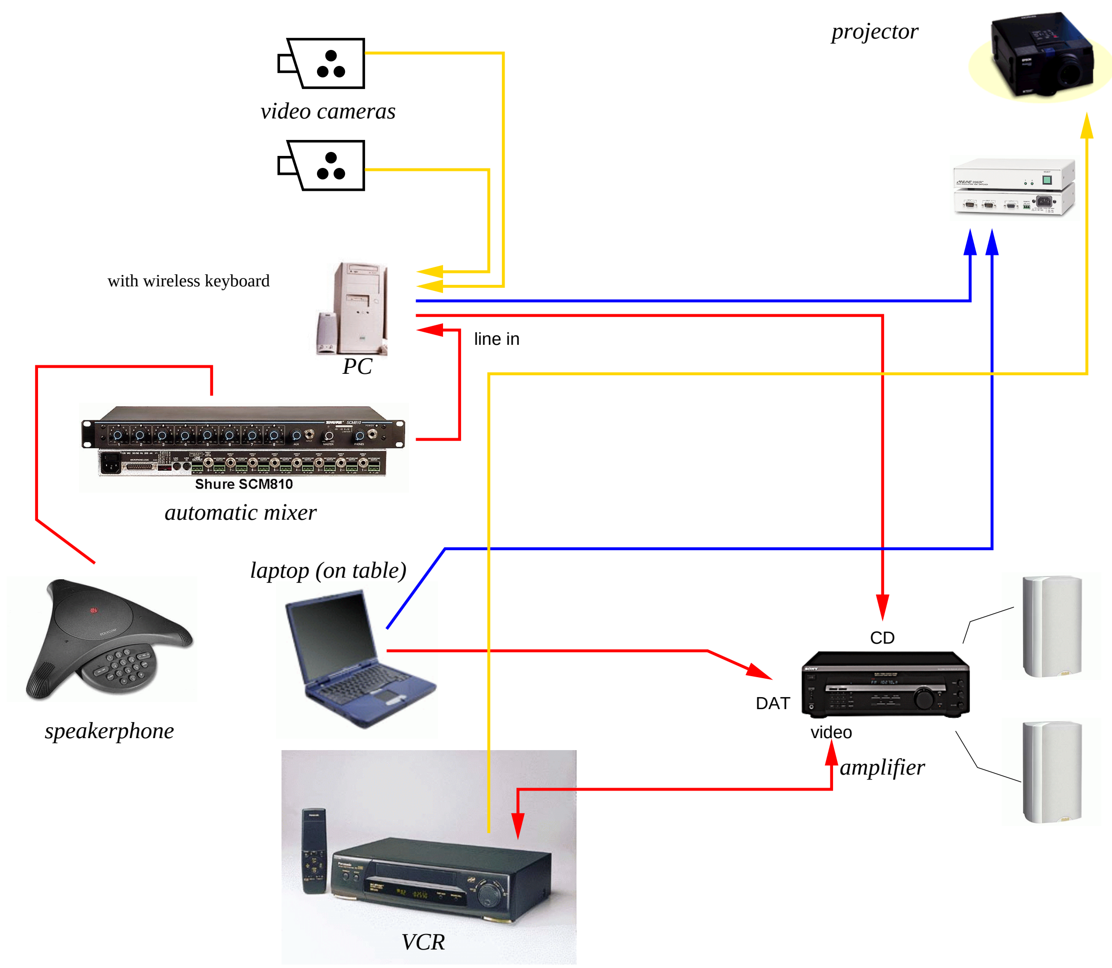
# Campus network

Cisco-based (6509) gigabit Ethernet:

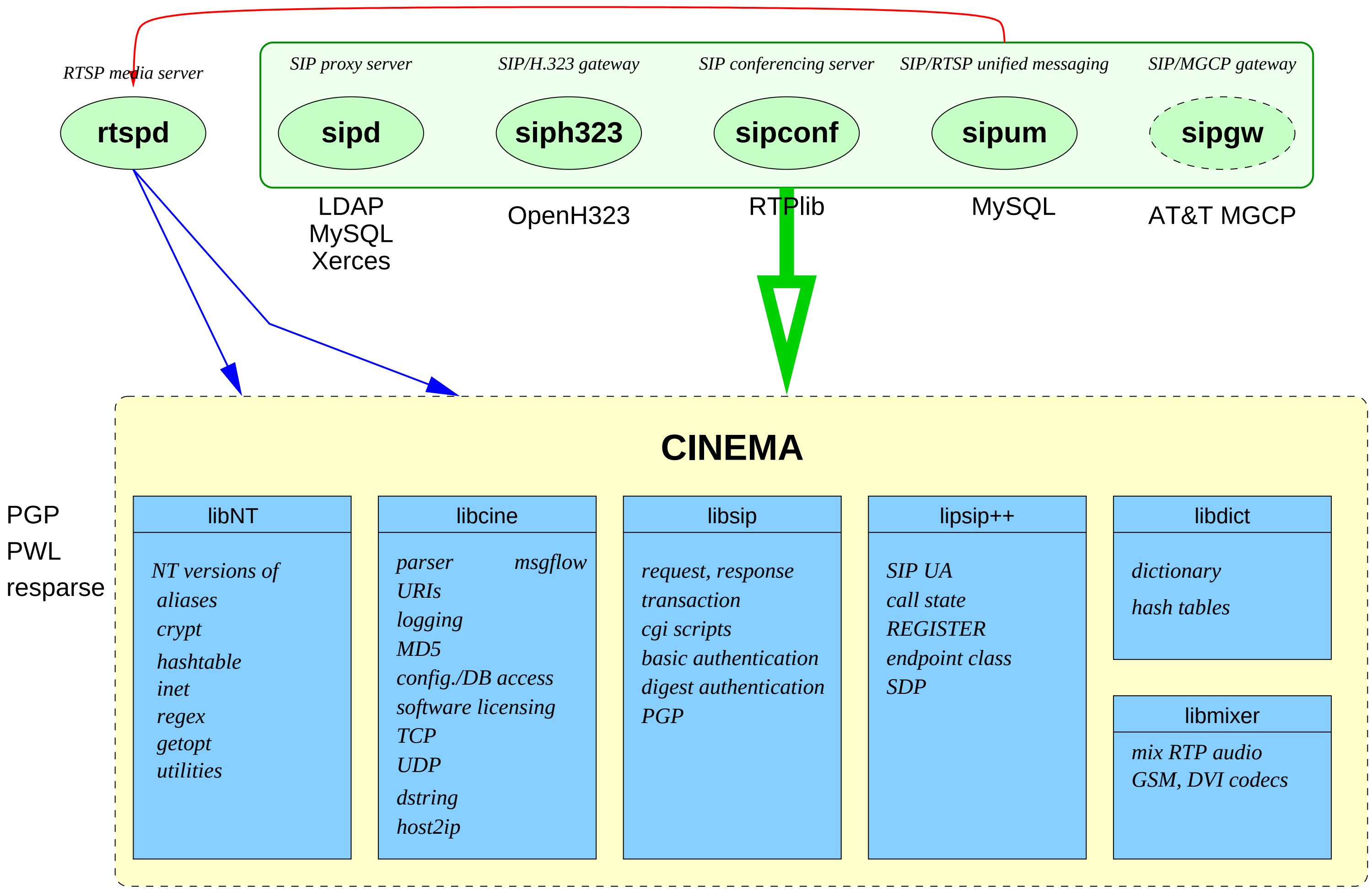



At least 4 switched jacks in each office.

# Columbia University CS conference room



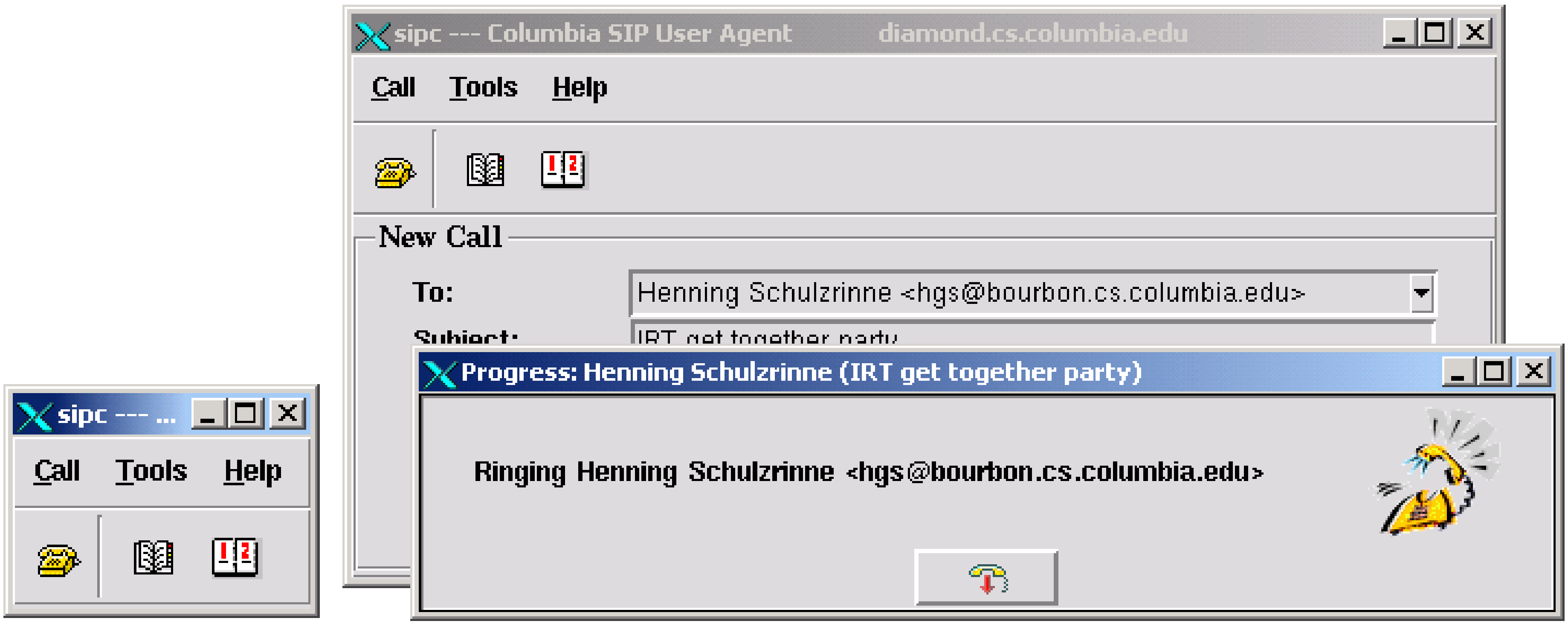
# CINEMA


RTSP media server
rtspd
SIP proxy server
sipd
SIP/H.323 gateway
siph323
SIP conferencing server
sipconf
SIP/RTSP unified messaging
sipum
SIP/MGCP gateway
sipgw
LDAP
MySQL
Xerces
OpenH323
RTPlib
MySQL
AT&T MGCP
PGP
PWL
resparse
CINEMA
libNT
NT versions of
aliases
crypt
hashtable
inet
regex
getopt
utilities
libcine
parser
msgflow
URIs
logging
MD5
config./DB access
software licensing
TCP
UDP
dstring
host2ip
libsip
request, response
transaction
cgi scripts
basic authentication
digest authentication
PGP
lipsip++
SIP UA
call state
REGISTER
endpoint class
SDP
libdict
dictionary
hash tables
libmixer
mix RTP audio
GSM, DVI codecs

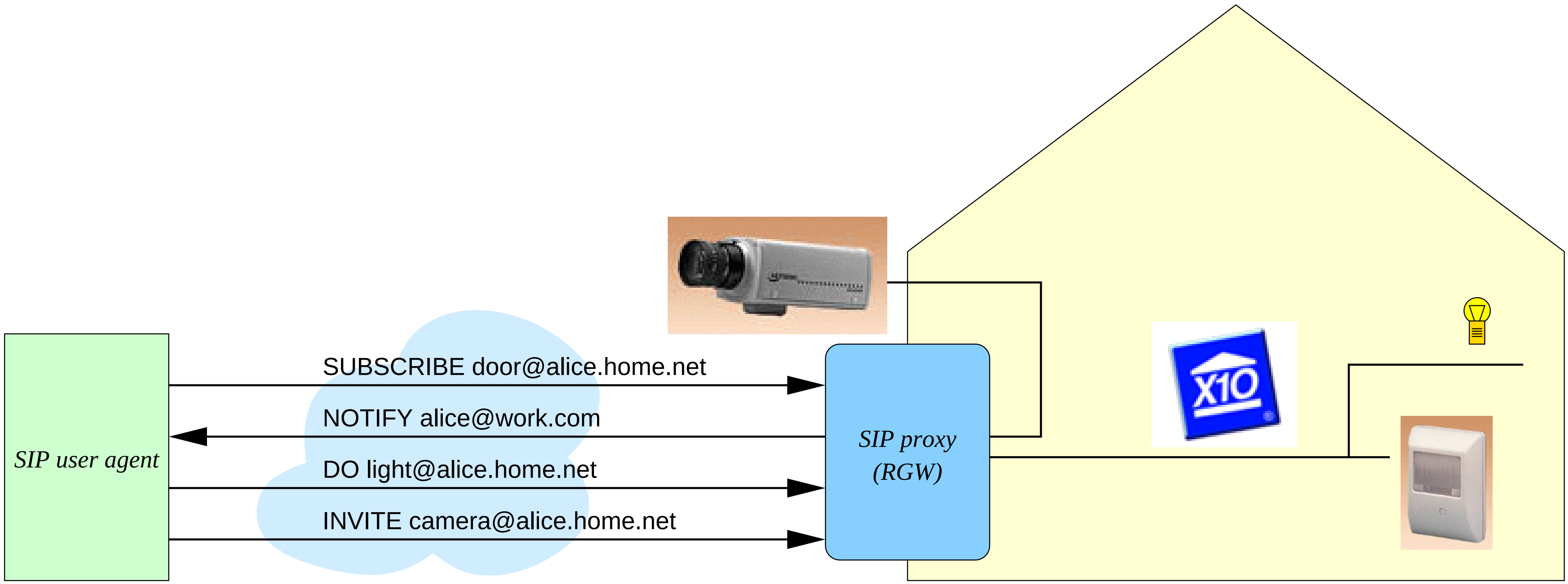
# e*phone

DSP-based, single-processor Ethernet phone; being commercialized


# SIP user agent sipc



# Device control



# sipd – SIP proxy, registrar and redirect server

- core call routing and feature component
- performance-optimized parser and implementation
- Apache-like configuration file and request logging
- basic, digest and PGP authentication for calls and registration
- user information stored in SQL database
- name resolution via access to LDAP directory
- supports SIP cgi and CPL (soon) for implementing features
- canonicalization of names: John.Doe, J_Doe, J.Doe, doe, ... $\longrightarrow$ jd123
- translation of `tel` URLs and dial-plans

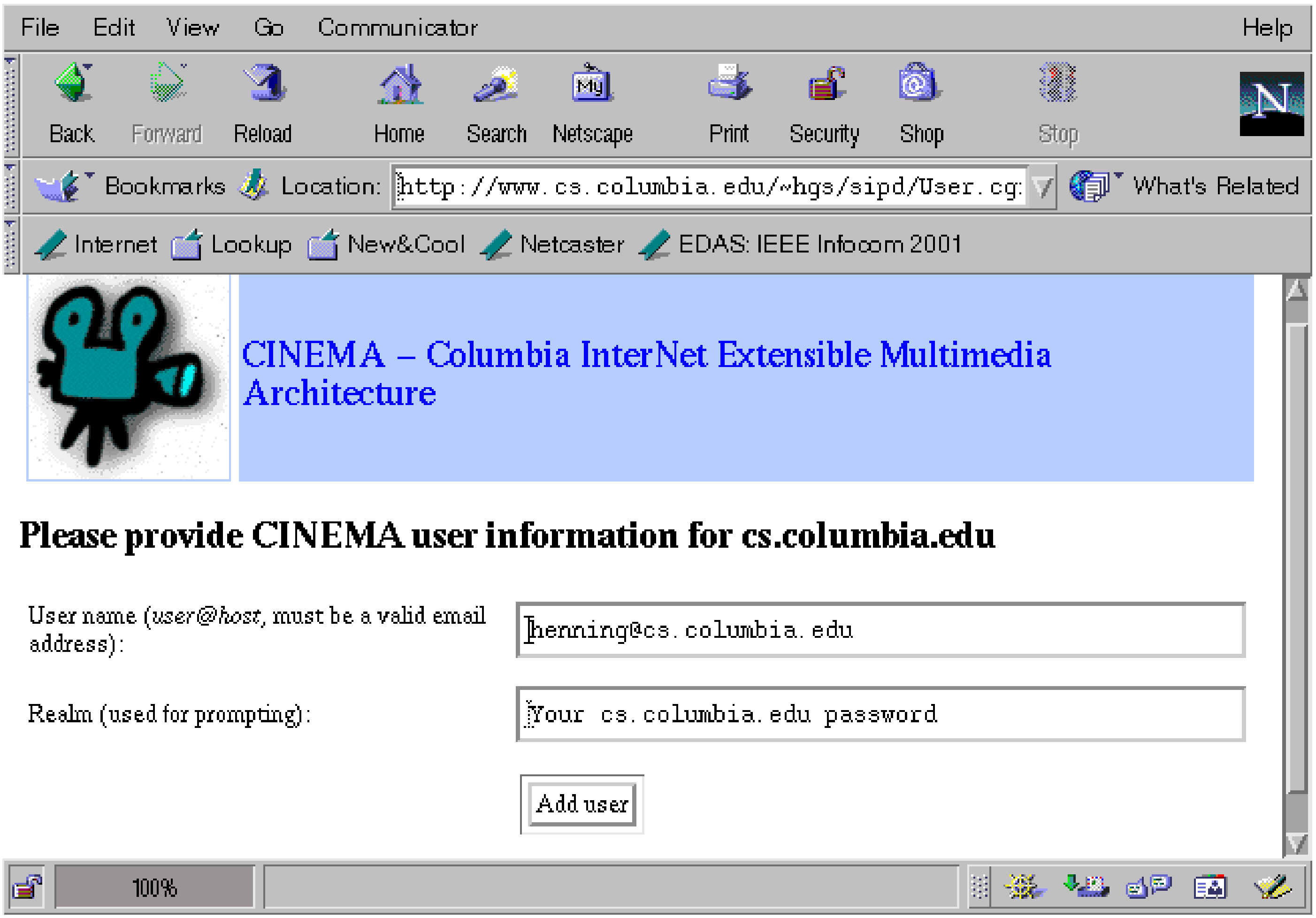
# CINEMA Registration

Email send to `henning@cs.columbia.edu`:

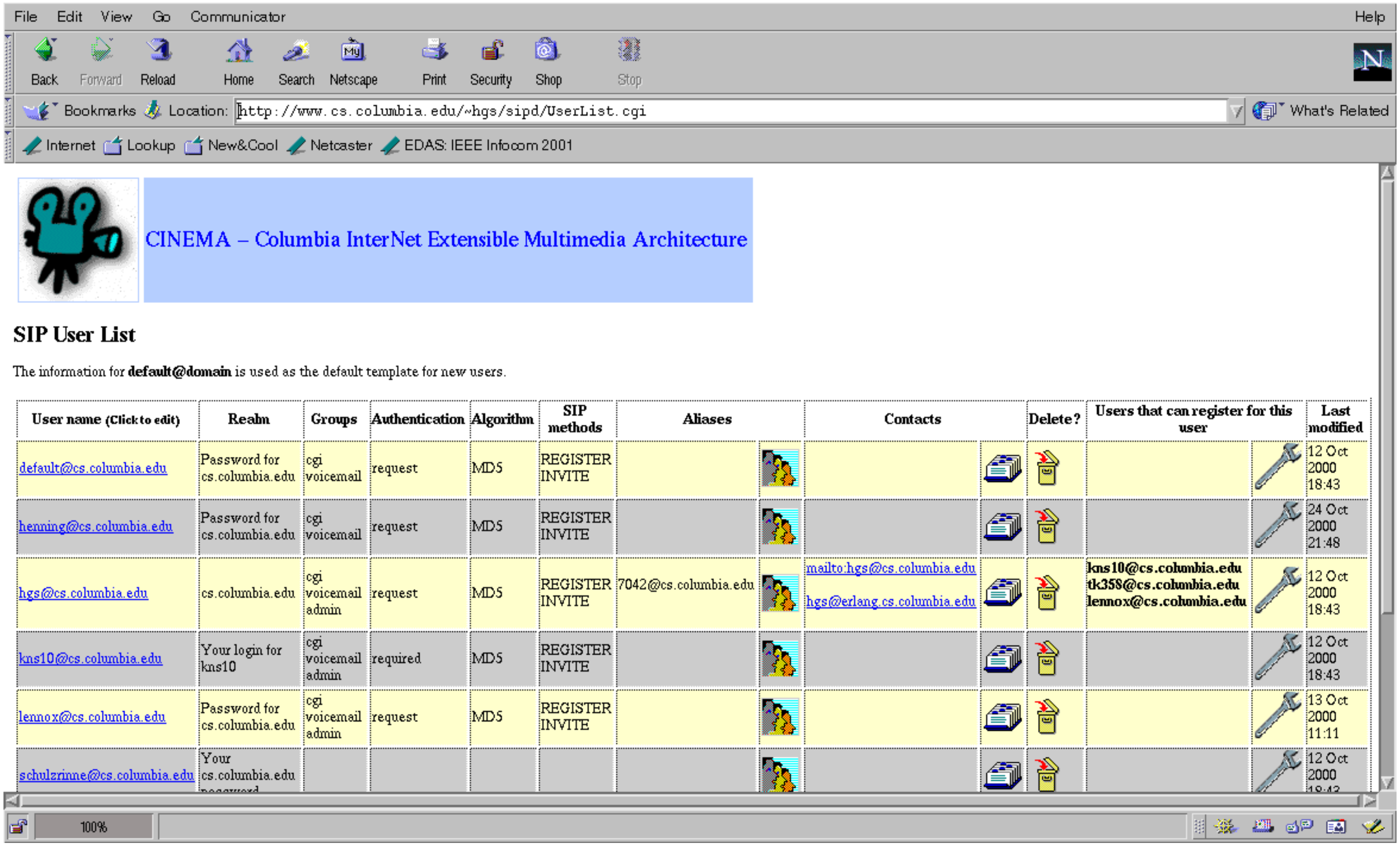
```
Subject: Your CINEMA registration
Date:    Tue, 24 Oct 2000 21:48:09 -0400 (EDT)
From:    <CGI.script.-.do.not.reply@cs.columbia.edu>
To:      henning@cs.columbia.edu

Your new CINEMA password for cs.columbia.edu is
"deduct.transversal.desert".
The realm is "Password for cs.columbia.edu".
```

# sipd single sig-on



# sipd user configuration




CINEMA – Columbia InterNet Extensible Multimedia Architecture

## SIP User List

The information for **default@domain** is used as the default template for new users.

| User name (Click to edit) | Realm | Groups | Authentication | Algorithm | SIP methods | Aliases | Contacts | Delete? | Users that can register for this user | Last modified |
|---|---|---|---|---|---|---|---|---|---|---|
| default@cs.columbia.edu | Password for cs.columbia.edu | cgi voicemail | request | MD5 | REGISTER INVITE | | | | | 12 Oct 2000 18:43 |
| henning@cs.columbia.edu | Password for cs.columbia.edu | cgi voicemail | request | MD5 | REGISTER INVITE | | | | | 24 Oct 2000 21:48 |
| hgs@cs.columbia.edu | cs.columbia.edu | cgi voicemail admin | request | MD5 | REGISTER INVITE | 7042@cs.columbia.edu | mailto:hgs@cs.columbia.edu hgs@erlang.cs.columbia.edu | | **kns10@cs.columbia.edu tk358@cs.columbia.edu lennox@cs.columbia.edu** | 12 Oct 2000 18:43 |
| kns10@cs.columbia.edu | Your login for kns10 | cgi voicemail admin | required | MD5 | REGISTER INVITE | | | | | 12 Oct 2000 18:43 |
| lennox@cs.columbia.edu | Password for cs.columbia.edu | cgi voicemail admin | request | MD5 | REGISTER INVITE | | | | | 13 Oct 2000 11:11 |
| schulzrinne@cs.columbia.edu | Your cs.columbia.edu | | | | | | | | | 12 Oct 2000 |

# SIP unified messaging

- receives SIP calls: forwarding, forking proxy
- uses RTSP server to play back announcement
- record audio (and, later, video) from caller
- playback through any RTSP-capable client, such as Real, QuickTime, . . .

# SIP conferencing

- multipoint control unit for audio and video conferences
- mixes audio, replicates video packets
- “dial in”: just dial `faculty-meeting@cs.columbia.edu`

# SIP-H.323 translation

- allow SIP devices to *transparently* call H.323 systems (e.g., NetMeeting)
- allow H.323 to call SIP devices
- serves as H.323 GK to register H.323 participants with SIP registrar

# Some future plans

**Java SIP library:** not just parser, but complete SIP & SDP implementation for UAs and proxies

**sipc:** instant messaging & presence

**Conferencing:** video distribution, floor control, conference timing

**Unified messaging:** access from POTS, VPIM

**sipd:** CPL, performance evaluation, enum

# Other on-going IRT research

- ad-hoc mobile data exchange: DS7
- adaptive reservation and billing: RNAP
- resource reservations: YESSIR, BGRP

# Summary

- complete architecture and set of components for building SIP parts of
  - VoIP ASP (“IP Centrex”)
  - IP PBX
  - carrier VoIP network
- standards-compliant and cross-platform
- independently deployable, but common code base and administration