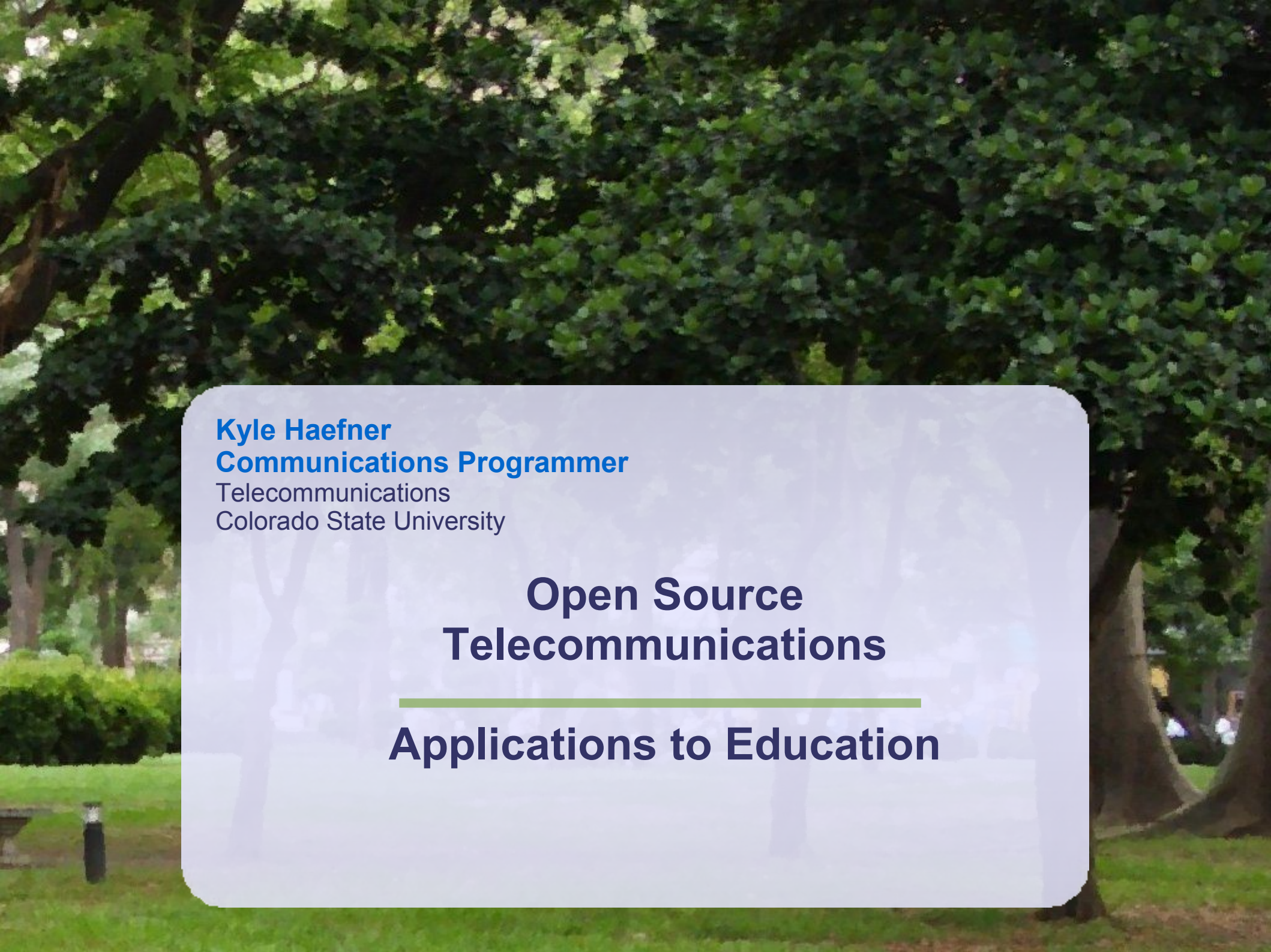

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Open Source Telecommunications

Applications to Education

The Ongoing Dilemma

- Current telephony equipment is becoming obsolete
  - Expensive maintenance
  - Forced upgrades
  - Limited functionality
  - Vendors ending support

Alternatives?

- Pay the price and upgrade
  - Upgrading SL100 will cost $$$,$$$
- Find other vendors
  - Cisco
  - Avaya
  - etc.
- Explore open source solutions
  - Asterisk
  - SER (Sip Express Router)

CSU's Answer

1. Use Asterisk as a voice mail service
   - Integrates with current SL100 telephone switch
   - Provides features not found in Octel (Web)
2. Replace Cisco Call Manager with Asterisk + SER
   - ~150 phones
3. Provide unified phone service to satellite campuses and cooperative extensions.
   - Networked Asterisk servers running on inexpensive hardware linked to main campus
4. Transition campus to VoIP using Asterisk + SER
   - We have about 5 years before expensive *forced* hardware upgrade.

The Asterisk Open Source PBX

- Asterisk is a complete software PBX (Private Branch Exchange)
- It runs on Linux, BSD, OSX, Windows*
- It runs on off-the-shelf hardware
  - It will even run on an $60 wireless router!
- It can inter-operate with almost every standards-based telephony equipment
- It is highly scalable
- And it's open source!!!

Where Asterisk came from

- Created by Mark Spencer
- Supported by a company called Digium
  - http://www.digium.com/
  - Sell PCI cards that work with Asterisk
- Contributions from over 300 volunteers

Asterisk PBX Features

- VoIP (Voice Over IP)
  - All common protocols (SCCP,SIP,MGCP,H.323)
- Voice mail services with directory
  - Voice mail integrates with email
  - Stream through a browser
- Call conferencing
- Interactive voice response
- Call queuing
- Music on hold
- Text-to-Speech
- more, More and MORE!

Who's Using Asterisk?

- Vonage
  - Voice mail
- Frys Electronics
  - Large Analog Telephone Installation
- University of Pennsylvania
- University of Utah
- Colorado State University
- Many More

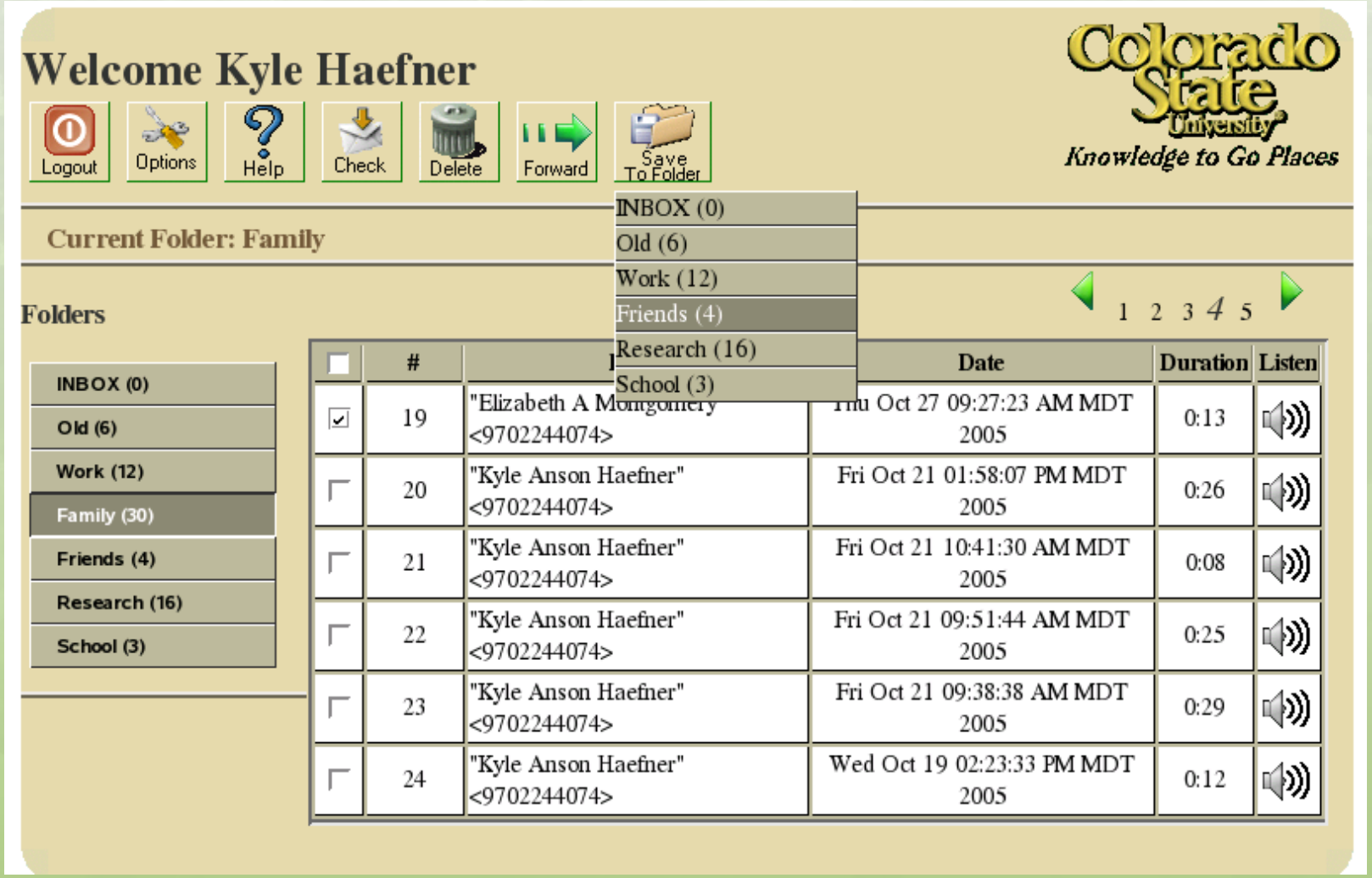
Comparison: Octel Aria and Asterisk

Octel	Asterisk
Cost of Octel Aria 350 $251,040.00	Cost of Asterisk System and hardware $2,335.00
Hard drive 842MB	Hard drive 400GB
72KB for a one minute message	72KB for a one minute message.
195 hours of messages	10.6 ***YEARS*** of messages
11,700 messages	~55 MILLION messages

Asterisk Voice Mail - Progress

- Wrote web interface in PHP
  - Stream voicemail, reply, forward
- Phone menus
  - Modified to mimic Octel menu structure
  - Added Octel functionality not native to Asterisk
- SMDI (Simplified Message Desk Interface)
  - Connects Asterisk to SL100
  - Message waiting indicator
    - Integrated with both phone and web

Asterisk Voice Mail - Web-VMail



Asterisk Voice Mail -Features

- Stream messages through a browser
- Email alerts of new Voice Mail
- Voice mail attached to e-mail
- Reply directly through the web (Java applet)
- Coming soon!
  - Simple Message System (SMS) support for mobile devices.
  - Instant Messenger integration.
  - Integration with campus calendaring
    - Set/Remove of extended absence greeting
    - Go straight to voice mail following schedule

Asterisk Voice Mail - Time line

- July 2005
  - Beta testing with members of faculty and staff
- January 2006
  - Students in the residence hall added to Asterisk
- August 2006
  - Campus using Asterisk

Future Projects – Asterisk PBX

- Purchased three more servers
  - 1 Will be a redundant voice mail server
  - 2 Will run SER (Sip Express Router)
- SER (Sip Express Router)
  - Open source sip proxy
  - Very fast 10,000 sip connections
  - Passes call to Asterisk for PSTN and voice mail
  - Linux high availably load balancing
    - UltraMonkey
  - DRDB (distributed replicated block device) for database and voice mail.

Future Projects – Customer Relationship Managers

- Integration with customer relationship managers
  - SugarCRM
  - CallerID based database look ups
    - Departments can get real time student information on computer screen when student calls in.

Future Projects – Text to Speech

- Uses the Festival Engine
  - Possibility of different voices
  - Ex: current weather in Fort Collins
- Possible applications at CSU
  - Interactive voice response
  - Email over the phone
  - Dynamic information over the phone

Future Projects – Voice Recognition

- Sphinx2
  - Open Source voice recognition software from Carnegie Melon University
  - Speaker independent
  - Uses finite dictionaries
  - CSU -> (See a shoe)
- Live demonstration of this is at:
  - http://www.cs.cmu.edu/~dbohus/RoomLine/

Future Projects – Schedule Based Call Routing

- Integration with campus calendaring system
- FreeBusy - PHP application
  - Queries an MS Exchange server
- Follow-me application rings phones based on schedule
- Greetings reflect schedule status

Future Projects – Ring Tones

- Ring melodies set from a web interface
  - Allows easy audible differentiation of calls based on calling number
- Ring by name
  - SIP phones announce the caller in his/her own voice
  - Uses user recorded greeting

Future Projects – High Availability

- UltraMonkey Suite
  - Fast load balancing using the Linux Virtual Server
  - Flexible high availability provided by the Linux-HA framework
  - Connection synchronization allows connections to continue even if the active Linux-director fails and the stand-by is brought on line
  - All code is open source

Future Projects - Redundancy

- DRDB – Disk Replicated Block Device
  - Block device which is designed to build high availability clusters. You could see it as a network RAID-1.
- Will synchronize voice mail and MySQL database across multiple machines.

Future Projects - Asterisk on a Linksys Router

- Cooperative Extension - CSU
  - Centralize phone service
    - Provide long distance and localized campus service
  - Uses cheap hardware

Pros and Cons of Open Source Telephony

Pros:

- "Swiss Army Knife" of Telecommunications
- Cost
- Infinitely customizable
- Vendor independent
- Rapid development cycle

Cons

- Requires in-house expertise
- Support
- Rapid development cycle

Pro and Cons of Proprietary PBXs

Pros:

- Support
- Choice of many vendors
- Well-defined cost model

Cons

- Can't change code
- Expensive
  - Pay for every feature
  - Pay for upgrades
- Vendor lock in!
  - No choice in hardware

References

- Asterisk
  - http://www.digium.com and http://www.asterisk.org
- SIP
  - http://www.iptel.org/ser/
- Voice Recognition
  - http://www.speech.cs.cmu.edu/
- CRM
  - http://www.vtiger.com/
- High Availability
  - http://www.ultramonkey.org
- Redundancy
  - http://www.drbd.org/

Questions and Comments

Thank You!