UHNet and Beyond

Jan Kawachi
Information Technology Services
kawachi@hawaii.edu
Nothing is exciting about
a big, empty pipe.
Purpose of the UHNet

- Connect People to People
- Connect Machines to Machines
- Connect People to Machines (Information)
...to support the University community as they find new ways to use emerging applications to do research, teach/learn, and administer the University.
Support Emerging Applications - Research

- Remote Observing for Astronomy using the Mauna Kea Observatories
- Transfer of large satellite images
  - Study active volcanoes
  - Weather modeling
- Transfer of large datasets for the study of elementary particles
Support Emerging Applications – Teaching and Learning

- **Distance Learning**
  - One-way delivery - Streaming video
  - Interactive –
    - Broadcast quality using Mpeg video
    - IP-based H.323 standard audiovisual conferencing

- **Web-Based Training**
  - WebCT
Support Emerging Applications – Administration

- Web-based Administrative applications
- Video conferencing
Today’s Agenda

- Exploring the UHNet
- What’s Next?
UHNet????
Internet Protocol-based network that services 10 of the University of Hawaii campuses and 60 remote sites

– Western most point is Kokee on the island of Kauai

– Eastern most point is UH Hilo and Hawaii Community Colleges
Network of Networks

Wide-Area

Core

Manoa
UHNet

- External Networks
- Internal Networks

Core
Connects External Networks

- Internet
- Internet2
- State of Hawaii
- UHNet Core
- Hawaii Internet eXchange
Internet (commodity)

- DS3 (45 million bits per second) through Genuity (formerly GTE)
- Point-of-Presence at Verizon’s Alakea Street facilities
Internet2 is a project led by over 180 US universities in partnership with industry and government.

Purpose is to develop and deploy advanced network applications and technologies needed for the next generation of Internet Services.
Internet2

- UHNet connects to Internet2 via the Abilene Network at Sunnyvale, California.
- DS3 (45 million bits per second) shared link through the Defense Research and Engineering Network.
- First US university link established utilizing a unique agreement between federal agencies.
Purpose:

- Exchange point for national and international high performance networks
- Share expensive wide-area network resources
Hawaii Internet eXchange

- Allows local Internet Service Providers to exchange local traffic through a neutral site
- Reduces traffic on UH and ISP’s Internet links
Hawaii Internet eXchange

ISPs

Pihana Pacific

UHNet Core

ISP's

DS3 (45 million bit per second)
Verizon Frame Relay

DS3 (45 million bit per second)
TimeWarner
State of Hawaii

- Through the Division of Information and Communication Services
- 10 million bits per second
- State Hawaii Wide Area Integrated Information Access Network (HAWAIIAN) intra-island synchronous optical network (SONET) system
Connects Internal Networks

- Core
- Manoa
- Wide-Area
Wide Area Network

- Oahu campuses
- Neighbor Island campuses
- Wide Area
- Frame relay and DSL
Oahu campuses –
Honolulu CC, Kapiolani CC, Leeward CC, UH Manoa, UH-West Oahu, Windward CC

- Uses State HAWAIIAN network – Intra-island fiber
- SONET OC-3 (155 million bits per second) which has been recently upgraded to OC-12 (622 million bits per second)
- Fiber network installed by Oceanic as part of franchise requirements
- Fujitsu Add-Drop Multiplexers
Oahu campuses –
Honolulu CC, Kapiolani CC, Leeward CC, UH Manoa, UH-West Oahu, Windward CC

- T1 (1.544 million bits per second) connection from each community college
- Protected with backup 56 KB frame-relay through Verizon

![Graph showing bits per second over time]
Neighbor Island campuses – Hawaii CC, Kauai CC, Maui CC, UH-Hilo

- Uses State HAWAIIAN network
  - Fiber backbone network each island
  - Digital microwave between islands
- T1 (1.544 million bits per second) connection from community college
- Protected with backup 56 KB frame-relay through Verizon
Verizon’s Frame-Relay and Digital Subscriber Line (DSL)

- Used mainly for offices located off campus on all islands
- Remote sites use Verizon’s offering of DSL or Frame Relay
- At UH, connect through a shared T1 (1.544 million bits per second) circuit
Frame-Relay and DSL using Verizon’s network

UHNet

T1 (1.544 million bits per second)

Verizon Frame Relay

DSL
Manoa Network

- FDDI network backbone
- 10 million bits per second connection from each building to the FDDI core
- primarily fiber from each building
Manoa Network

- Unshielded twisted pair cables to the desktop generally connecting at 10 million bits per second in a shared building network
- Static IP addresses (generally)
Summary of UHNet

- IP-based network
- Network for University of Hawaii system
- Interconnected using fiber cables, unshielded twisted pair cables, microwave
- Divided into 3 major categories:
  - Core
  - Wide-Area
  - Manoa
What’s Next –

Upcoming Projects
UHNNet Qualities

Capacity to support the bandwidth required

Reliable

Ubiquitous (everywhere at the same time)

Standardized

Secure

Reliable

Available 24-hours a day, 7 days a week
Increase bandwidth for Internet/Internet 2 traffic
- Initially to OC-3 (155 million bits per second)
- In the future, OC-12 (622 million bits per second)

OC-3 (155 million bits per second) links to Japan and Australia

Use fiber strands on the Southern Cross and Japan US transoceanic cables
HITS2 Project – Neighbor Island

- Increase bandwidth to all neighbor island campuses to OC-3 (155 million bits per second)
- Use separate digital microwave system
- Use Cisco routers and switches
HITS2 - Oahu

- Implement Dense Wave-Length Division Multiplexing using LuxN equipment
- Shared gigabit ethernet backbone with 100 million bits per second connections to each campus
- Additional shared OC3 (155 million bits per second) backbone through the Fujitsu FLM
- Shared OC-3 backbone on SONET using Fujitsu FLM
- Shared Gigabit ethernet backbone
Upgrade Bandwidth for Verizon Frame-relay

Verizon Frame-relay/DSL connection upgrade to DS3 (45 million bits per second)
Manoa Upgrade Project

- Layer 3 Switched Backbone using Cisco Catalyst 6506
- 100 million bits per second connection from each building to Switched Core
- Redundant connection from each building to core switches
Manoa Upgrade Project

- Partition shared building network into separate collision domains by connecting hubs to building switch
- DHCP (Dynamic Host Configuration Protocol)
- New service – switched network connection for end devices (10 or 100 million bits per second depending on building cables)
Typical Building Connection

- FDDI
- **UH Core**
- **Bldg. 37**
- **Keller**
- DHCP/Dynamic DNS server
- Shared redundant switch

**Typical Building Connection**
Wireless Project

Standards for implementing wireless technology to ensure security and ability to roam.

next Brown Bags topic ....
24 x 7 coverage

- Network Operations staff available on weekends
- During off-hours, call System Operations (956-2393). They will contact Network Operations staff
Summary

- Changes to the UHNet to support emerging local and global applications
- Timeframe: 6 months - 2 year period
Resources

- net.its.hawaii.edu
- www.internet2.edu
- www.japan-us.org
- www.southerncrosscables.com
Feedback

Jan Kawachi
kawachi@hawaii.edu
956-9595