Networks on Demand

A Roadmap

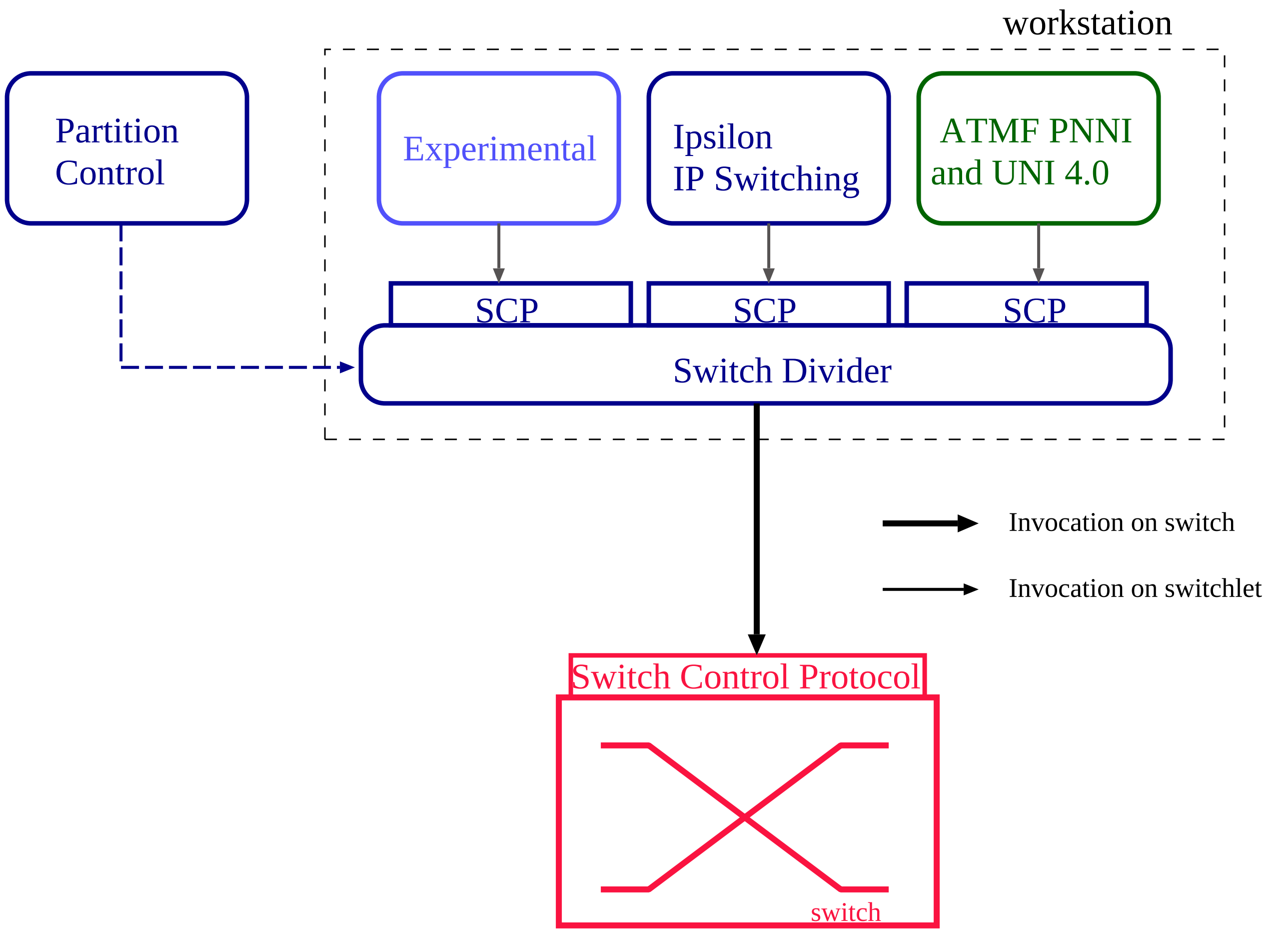
July 1997

University of Cambridge
Computer Laboratory

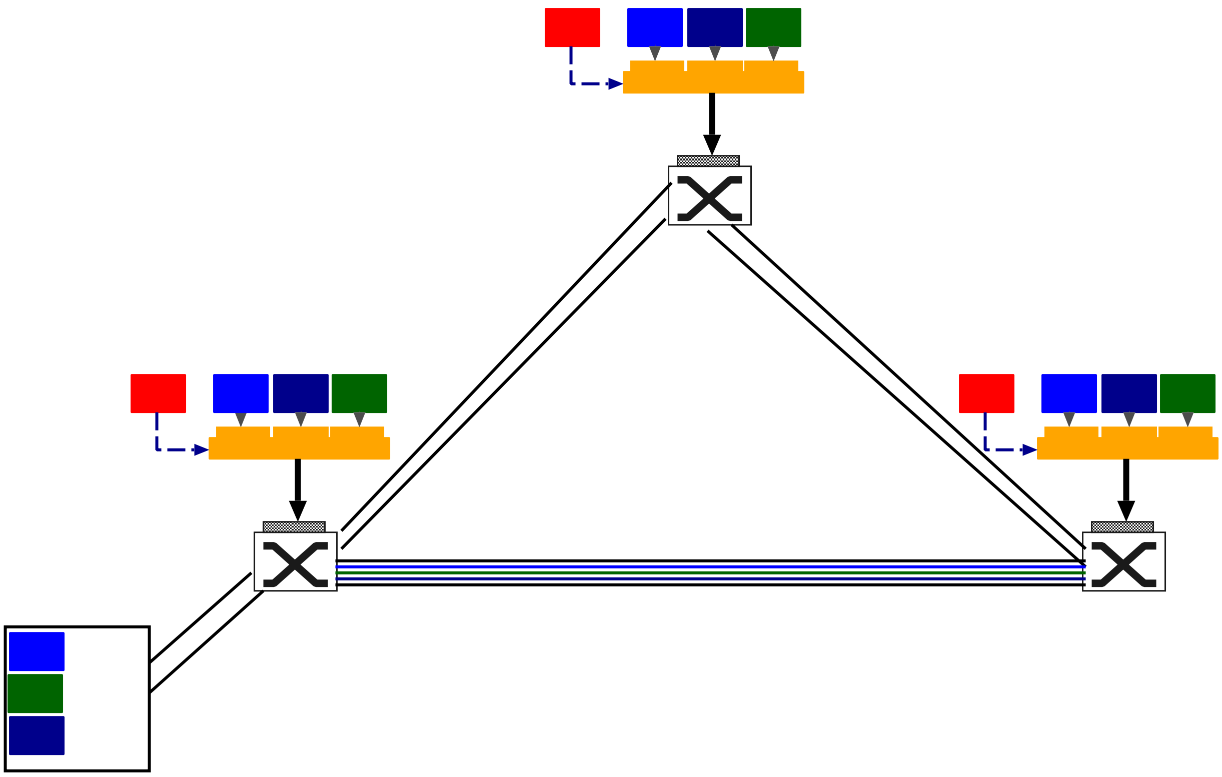
- What it is

- How projects fit together

Divider


workstation
Partition Control
Experimental
Ipsilon IP Switching
ATMF PNNI and UNI 4.0
SCP
SCP
SCP
Switch Divider
Invocation on switch
Invocation on switchlet
Switch Control Protocol
switch

Switchlet Based Virtual Networks



Creating Switchlet Based Networks

- need a bootstrapping control architecture
- (in our work we are using the Ipsilon IP control architecture)
- need system (network builder) which finds the appropriate switchlets and connects them together with consistent address space allocations
- network builder has to negotiate with the partition controllers to get the appropriate resources.

Using Dynamic Virtual Networks

- could create virtual networks with well defined control architectures

- could create virtual networks with "user" defined control architectures — could be specific to a particular service

- service specific control architectures

  1. keep the control system to minimum (only required features included)

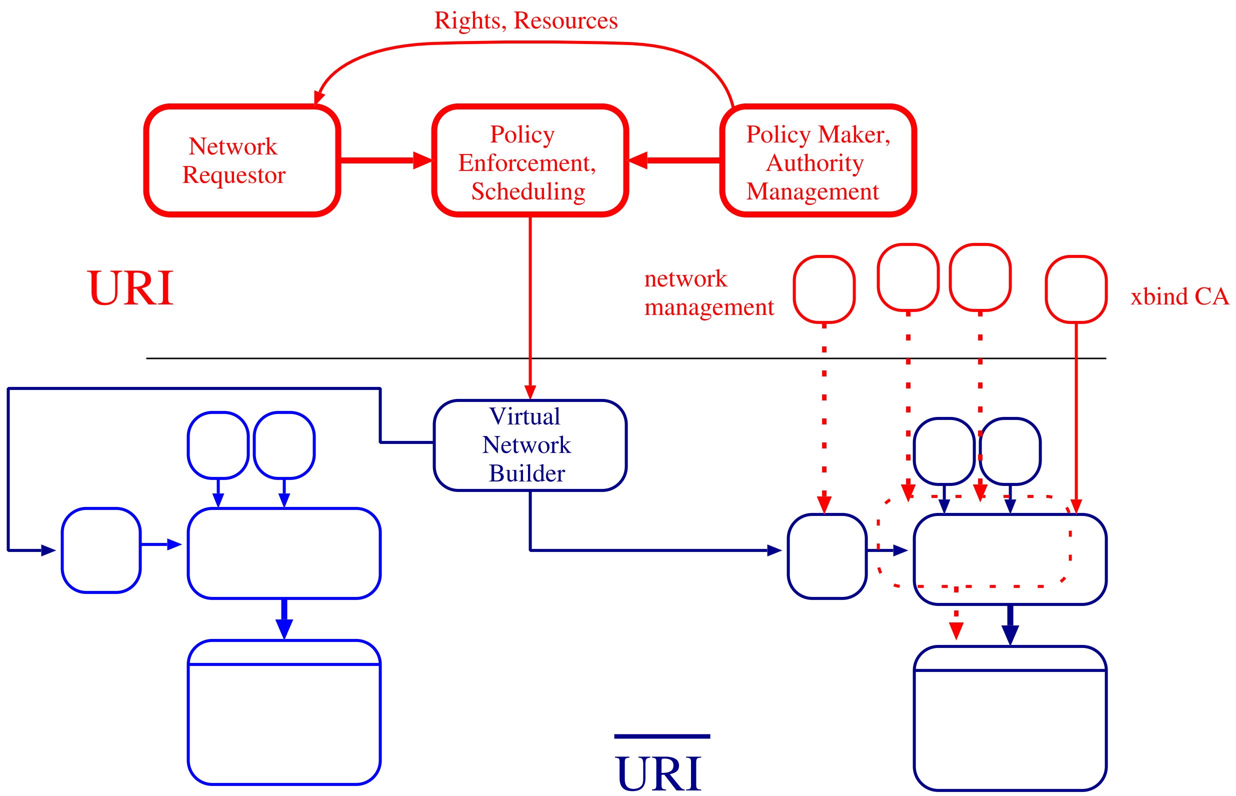
  2. take advantage of application knowledge to make more efficient use of resources

Networks On Demand

- dynamic virtual networks based on the switchlet concept can be used to create a Network On Demand service
- requires policy decisions about who is allowed to create networks and under what conditions (slow time scale)
- requires scheduling to allocate link capacities (slow time scale)
- the control architectures themselves may do fast scheduling of the resource allocated to them
- a demanded network might exist for hours, days or years.

- by partitioning via switchlets, can run experimental and production networks on same ATM switches

- eg experimentation with connection admission control


Rights, Resources
Network Requestor
Policy Enforcement, Scheduling
Policy Maker, Authority Management
URI
network management
xbind CA
Virtual Network Builder
URI

Projects, etc

- URI

- DCAN : APM, FORE, CUCL

- Pegasus II : APM, Twente, SICS, Glasgow, CUCL

- Learnet : BT, Nortel(?), UCL, Essex, CUCL

- misc CUCL

Talk about contribution to NOD, not about complete projects

URI

- so far:
  - security (incl threat) model
  - GSSI API use, secure signalling
  - policy specification and enforcement tools $\leftarrow$ IC
  - hooks into network builder for creation of networks
- planned:
  - prototype of upper layer: policy and network scheduling
  - xbind over switchlets $\rightarrow$ Lancaster
  - use in LEARNET

– performance studies

– network management implications: loadable code

– tracking/interworking with UCL ISP stack

DCAN

- so far:
  - experience with switch control and switch control interfaces, Ariel API
  - DIMMA over Nemesis (improved Nemesis)
  - secure booting
  - demonstrations of the effectiveness of devolved control
  - switchlets
  - network builder
  - connection closures
  - control architectures: Strawman, Hollowman, Videoman

- Opensig 97

- planned:
  - divider server over Nemesis
  - divider server in Solaris (export path)
  - loadable code for health functions

LEARNET (planned)

- realisation of NOD structure on wide area network
- new control architectures
- charging, resource management experiments
- network management experiments
- playground for new network architectures

Pegasus II

- so far:
  - Nemesis on Pentium, ARM, Alpha
  - Kaffe JVM on Nemesis
- planned:
  - anti-static tools
  - Ariel API for Kaffe on Nemesis
  - resource managed JVM
  - Java Orb port

Miscellaneous

- Sandman
- ATM Warren
- other companies