

# **Active Networks**

## **An Integrating Technology for Research**

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# History of Heterogeneous Nets

- **Early '70s emulating specific terminals**
- **'75 - '85 JANUS application level gateways**
  - **Slow, points of failure, pre-located**
- **'85 - '95 Rise of the routers**
  - **Packet forwarding functionality at network level**
  - **Originally agreed functionality for routers**
  - **Differences between intra and inter-domain**
  - **Start of QoS via IntServ**

# Recent Functionality Needs

- **Need more sophisticated functions in net**
  - **Little agreement on what functions and how**
  - **Support for real-time media and caches**
- **Like application-sensitive behaviour in net**
  - **Routers too sensitive to include experimental code**
  - **Boundaries between regions very important**
    - **Mobile, LAN, IPv6-IPv4**
- **Possible solution active functions in routers**

# UCL-CS M/c MM Conferencing

- Needs M/c  $\leftrightarrow$  U/c transform capability
- Filtering and transcoding at boundaries
- QoS support
- Reliable multicast
- Cached recording, replay, announcements
- Intelligent cache/proxy
- **All need active code inside the network**

# Security Research

- **Authentication and Confidentiality in Conferencing**
- **Watercasting - using properties of multicast**
- **Aids to deployability of M/c**
- **All need active code in the network**

# QoS and Pricing

- **Most conferencing and other services suffer from QoS problems**
  - **We have much QoS improvement work**
- **One factor in QoS is pricing**
  - **We have much pricing work - which implies also authentication and charging**
- **These always require active code inside the network**

# IPv6 Preparations

- **Several of our past projects had IPv6 as their basic environment**
  - **COIAS, MECCANO**
- **They gave us experience of the basic stacks**
- **Security, Routing and QoS policies were part of support for the services**
- **Policies were implicit or fixed**

- **We conclude that the continuation of much of this work benefit from Active services or networks - and they provide a unifying force.**



# Conferencing Developments

- **Tools OK, need boundary support for QoS, layered coding and media transformation**
  - **Started developing UTG, v2 in JAVA**
  - **Developing under RADIOACTIVE/ANDROID**
  - **Will be crucial in 6WINIT**
- **Reliable M/c needs support along M/c tree**
- **Recorders/Servers/Announcements need caches**
  - **Will provide recording cache in RAD/AND**
  - **Will provide playout caches in RAD/AND**
  - **Looking at web proxy for announcements**

# Security-related Developments

- **Some Orgs have not, or may not, deploy M/C**
  - **UTG will address in RAD/SCAMPI**
  - **Needs UTG functionality, also security. One mode is M/c <-> U/c, M/c <-> U/c <-> M/c**
- **Watermarking, QoS request, Pricing, Joining Conferens need authentication at Boundaries**
  - **Will provide facilities in ANDROID/SCAMPI**
  - **Hope to provide security libraries**

# IPv6 Developments

- **Many of our projects now involve IPv6**
  - **RADIOACTIVE, ANDROID, BERMUDA, 6WINIT**
- **All need more sophisticated use of policies**
  - **Security, routing, management, QoS**
- **Looking how to express and implement policies and their databases**
  - **Statically in some projects, dynamically in Active nets services**

# Move to Active Service Projects

- **Alpine (UK), ANDROID (EC) and RADIOACTIVE (US) all Application Level Active Networks (ALAN)**
- **All use the HIPPARCH/ALPINE FunnelWeb engine from UTS**
  - **Works with Proxylets written in JAVA**
  - **Has special Execution Environment (EEP)**
  - **Proxylets can be dynamically loaded from Web servers**

# Common Threads

- **Write as many of the modules in JAVA as possible**
  - **Allow move to IPv6 when available**
  - **Allow use under FunnelWeb**
- **Adding policy models described in XML**
  - **Can they be similar in different domains (I.e. security, routing, QoS)**
- **Adding topology discovery and auto-configuration**
  - **Will allow many earlier directions re-pursued**

# Mobile Nets and Security

- **Multi-level fast hand-over, auto-config**
- **Need to discover potential topology**
- **Need Security, QoS and IPv6**
- **Will use the full MECCANO applications plus webcasting and watermarking**
- **Needs media functions at boundaries**
  - **Experiments at mobile boundaries**
  - **Ideal place to use FunnelWeb**

# Current Projects

- **ALPINE, ANDROID and RADIOACTIVE** address this centrally in project
- **6WINIT, M3I, BERMUDA, SCAMPI** can be interpreted to develop and deploy activities from other projects
- **NGN** can be used to disseminate results

# Common H/w Base

- **Have ordered a multi-processor rack**
  - **initially 12 processor boards (6 with dual processor capability)**
  - **Can be roughly doubled**
  - **Has own 100 Mbps Switchable Ethernet Hub**
  - **PCs can link to outside world via Enet or directly to ATM or other nets**
  - **Remote H/w re-boot, switchable display**



# Common Proxylet Base

- **Basic application-independent needs**
  - **Loading, authentication, topology discovery, configuration, management**
- **Policy-related components**
  - **Loading, interpretation, enforcement**
- **Security-related components**
  - **Signing, authentication, encryption/decryption, ike or Key distribution**

# Specific Proxylets

- **Reliable Multicast**
- **Web-related proxylets**
  - **Web-caching, Document, zipping/unzipping**
- **Conference Related Functions**
  - **M/c <-> U/c, media transcoding, layer filtering, selective discard**
- **Recording/Playback**

# Future Experiments

- **Expect to build up substantial test network**
  - **Parts of it essentially IPv6**
- **Probably use FreeBSD with KAME stack**
- **Part of substantial wired and wireless net**
  - **RADIATIVE and 6WINIT involve wireless**
- **Linked in to various Wide-Area facilities**
  - **Possibly deliberately with security gateways and Virtual Private Networks for some projects**

# Conclusions

- **Several past projects have provided outputs that need a new focus**
- **Our active nets and mobile projects will provide some of the focus**
  - **With EE providing management input**
- **There is an excellent chance for the different projects, and groups, to collaborate together with an Active Services focus**