SuperJANET4 Development Programme: Forward Look

UKERNA

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0. Background

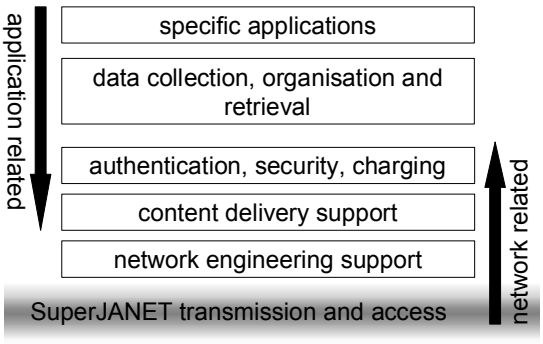
The SuperJANET4 Development Programme was inaugurated early in 2001 as part of the wider SuperJANET4 project. It was always envisaged that the programme would need to undertake relatively frequent reviews of content and direction, given the fast-moving technologies involved.

At the start of the programme the JISC's SuperJANET4 Advisory Panel helped the JISC Committee for Networking (JCN) to steer the programme. This Panel has since been disbanded, and the JCN is now establishing a new steering group for the specific role of advising it in the general management of the programme. Membership of the group will be drawn from across the range of research and education activities supported by the JISC.

An early activity for the steering group will be to develop with UKERNA a workplan for future activities. In this context UKERNA recently provided the JCN with a forward look at potential new areas of activity. This paper is derived from that forward look and its discussion by JCN members, and will inform the new steering group in its work. Its status at present is purely advisory and therefore constitutes JCN and UKERNA initial thinking in this area, not established policy for the future of the programme.

1. Introduction

The document describing the present SuperJANET4 Development Programme is available at http://www.ja.net/development. In this document a layered model for applications support was broadly characterised as follows:



The SuperJANET4 Development Programme focuses on network related support required by applications. In Sections 2 to 4 below each of the three major areas of network support are used to structure a high level view of the forward look for the programme. Sections 5 and 6 are anticipated new activity areas for the development programme. Information regarding work already under way within the programme can also be found via the above URL.

2. Authentication, Security and Charging

Authorisation (and implicitly authentication) mechanisms will be needed to access network resources as part of any Quality of Service (QoS) or bandwidth reservation offerings. Authorisation to use network resources implies their management which in turn means accounting for resource use and possibly charging. To date no activity has been initiated in this area and we feel that it is now time to start work to support the QoS development activity.

This area is potentially very broad and an infrastructure for authorisation, authentication and accounting is required for many other network based applications, for example access to

content or access to computing resources. It is important that as much of a common framework and infrastructure as possible is created to satisfy all requirements in this area and UKERNA will work the JISC and e-Science funded initiatives to this achieve this end. In this context it will be important to integrate recent work by the JISC Executive in defining a framework for authentication services.

3. Content Delivery Support

Co-location services from the SuperJANET Core Points of Presence are now being offered. Work to develop hosted services and peering services will be started in the near future.

The results of the JISC / UKERNA collaborative activity to develop and trial a broad-based media hosting infrastructure is likely to conclude that the requirement exists and it is technically feasible to establish such an infrastructure on JANET. It is expected that development in this area will need to continue beyond the current project.

Further work to develop IP based videoconferencing services beyond the implementation of a pilot service later this year will be required, particularly in the area of booking services and automation of some of the service management processes. A requirement for a high quality videoconferencing services (possibly to HDTV standards) has also been expressed. This has arisen in particular within Scotland, where high-bandwidth ATM-based services are being phased out in favour of more scalable IP-based services.

The requirement to support voice on JANET is also beginning to be expressed from different sections of the community. Much of the infrastructure that will be implemented on JANET to support IP based videoconferencing services could be used as a basis for supporting voice services. The need to move from voice services to telephony services still needs to be researched The ability to support reliable voice, and in particular telephony, services over JANET will depend upon a consistent and high level of support from the network.

The delivery of content via digital television promises not only high quality pictures and sound but also the possibility of interaction between the consumer and provider. These characteristics, combined with its increasing availability make digital television a candidate for an efficient means of delivering education content.

4. Network Engineering Support

Present activities to prototype QoS services will lead to the gradual introduction of production-quality QoS services. These activities will need to continue beyond the current prototyping, progressing to, for example, the possible integration of network intelligence techniques, which will allow automated network reconfiguration to respond to user requirements at any given moment providing resources are available and authorisation has been given for access to it.

There may also be a requirement to support IP virtual private networks (VPNs) across JANET. This is might arise if there is significant demand from institutions to establish VPNs to connect distributed sites. It might also arise as the user base for JANET widens and individual communities or sectors see the need for identifiable VPNs to serve their members. Such VPNs would not primarily constitute a means of delivering IP QoS but might be of use in delivering privacy and similar requirements.

The development of a manageable multicast infrastructure across JANET is becoming increasingly important as an efficient method of distributing large volumes of content and to support collaborative tools such as AccessGRID that is being prototyped by the e-Science community. Current experience shows that end-to-end management of multicast infrastructure is a significant operational problem, and one that requires better definition of standards plus improved central support facilities.

As time goes on the drivers for IPv6 are becoming more pronounced. Participation by UKERNA and the other UK partners in the European project 6NET will build invaluable experience of implementing and managing an IPv6 based network and understanding the issues involved in moving from IPv4 to IPv6. The development of the recently launched JANET IPv6 experimental service will continue which will naturally evolve towards supporting native IPv6 services across JANET.

Beyond the piloting and possible introduction of a JANET ADSL service UKERNA is already investigating other network access technologies with a view to either the provision of advice or the development, where feasible, of JANET services. Examples of other technologies that will be investigated are: Cable Modems; Satellite; Fixed Wireless; and Mobile Wireless. First trials of one potential satellite solution are just getting underway but a number of other services are also appearing and these must also be investigated in detail. There is a clear link here with the potential for delivery of content via digital TV.

Complementary to this, support for location independent networking needs to be continued so that any new network access technologies can be properly exploited. This is likely to link directly to the IPv6 work as many of the next generation of mobile IP devices will use IPv6 facilities.

Many of the developments that have been outlined above will lead to services with SLAs. This implies that the appropriate service infrastructure can be both monitored and measured with high granularity and often in realtime. Development work in the area of monitoring and measurement will therefore be needed to support these aspects of the SuperJANET4 development programme.

5. SuperJANET Transmission and Access

The contract with WorldCom for the provision of the SuperJANET backbone includes a technology (and pricing) review to be completed during 2003. The contract itself runs until the end of 2005. Given the lead times for procurement, it will therefore be necessary to start towards the end of 2002 the process of specifying and funding a replacement to this contract.

In this context, SuperJANET will need to move beyond 10Gbit/s trunk links and a directly controlled optical transmission infrastructure may be part of the solution to integrating the diverse requirements of both general users and the research communities. Momentum is building towards developing the case of establishing an optical networking test-bed for use by the UK research community and UKERNA so that next generation network services can be developed. Data intensive e-science applications are likely to provide early trials for these techniques.

To support these development activities and the requirements of the research community flexible network development infrastructure that has both a national and international scope is important. SuperJANET currently provides a core development facility that is separate from the production network. UKERNA will need to work with the research community to develop a framework under which this development infrastructure can meet the evolving demands of the research community. A particular challenge will be to extend access to the development facilities from the individual research laboratory.

6. Network Reliability

A more immediate issue is the increasing demand for ever greater levels of reliability within the production network. The backbone itself has relatively high levels of resilience built in but this is not necessarily the case closer to the edges of the network. Operational experience has shown that despite the best efforts of UKERNA and the regional network operators fault fixing by telecommunications operators continues to leave much to be desired. In addition the SuperJANET architecture is one of multiple management domains which in itself adds to the complexity of fault management.

It is clear therefore that work on these issues will need to be complemented with a greater reliance upon technologies within the network to provide resilience against failure of individual components. This engineering is not necessarily complex in itself, but the economics are—it is equally clear that the JANET budget alone will not be sufficient to meet all that could be done. It seems likely that individual institutions and the regional networks to which they subscribe will in future be asked to contribute to the costs of providing greater resilience at local and regional level. Therefore it will be important to gain real operational experience of the cost effectiveness of the various options available in order that informed decisions can be made.