

# ITS 413 – ASSIGNMENT 1

## Background:

You run your own ICT consulting business. One part of your business is to provide technology briefs to organisations that are considering new infrastructure and/or opportunities. As an expert in the field, these organisations come to you to get advice on current and future technologies. These organisations, which are your clients, are interested in:

- Background information on the technology, including real-world examples that can be used to present to the Client's Board Members. Short, but clear descriptions of the technologies are needed, as well as examples that motivate the need for such technologies and explain how they work.
- Clear technical descriptions, to sufficient detail that the Clients own IT employees can understand and evaluate the technology. This includes diagrams illustrating network architectures, protocol stacks, and sometimes even example protocol exchanges. Tables summarising technical data are also very useful.
- Evaluation of the technical, business and financial trade-offs of the technology (compared to alternatives), so decisions can be made by technical, financial and business managers. Tables and lists summarising advantages and disadvantages are useful for such evaluations.

## Task:

Your task is to prepare the technology brief for your Client. The scenario and scope of the brief is given for each client in the following sections.

Based on your past experiences, you know that:

- The brief must be professional presented (e.g. formatted well, clear diagrams, references/bibliography).
- The brief should be structured following the questions agreed upon in the scope. You should choose meaningful section names (not necessarily the same as the questions), and may even use sub-sections (e.g. a sub-section for technology 1, another sub-section for technology 2 and so on).
- The brief will probably be between 5 and 10 pages, although there are no upper or lower limits. The introductory material (e.g. for Board Members and Managers) will be about 1 page (although longer if several diagrams), the main technical discussion about 4-6 pages (again, longer with several diagrams), and the concluding material about 1 page.
- As the scenario and scope is not fully defined, the brief does not have to give strong design recommendations. It is more important to identify and present the trade-offs (advantages and disadvantages), so that the Client can then make a design decision. Also you may make some reasonable assumptions about the scenario if needed (as long as the assumptions do not make the scenario trivial). You should state any assumptions made.

## Deliverables and Milestones:

You must deliver the brief as either printed hardcopy, or as emailed softcopy (PDF attachment only), but the deadline of: \_\_\_\_\_

**Topic 1: Routing in Mobile Ad Hoc Networks****Client:** Defence Networking Company**Scenario:**

The Client sells networking solutions to the defence industry (that is, mainly to governments). To date, the Client's main focus has been on fixed, wired Internet-based solutions.

The Client is aware of Mobile Ad Hoc Networks (MANETs), and is considering expanding their network solutions to include MANETs. That is, in the future, the Client would like to sell hardware and software to governments that will allow the government's military to operate MANETs. Such MANETs would typically be quite large (100's of nodes to possibly 10,000+ nodes), require high survivability and be highly dynamic.

However, the Client does not have any experts in the field of MANETs, and would like to understand how they work. In particular, they are interested in the routing issues in MANETs (compared to the Client's knowledge of routing in the Internet).

**Scope:**

After initial project planning and brainstorming meetings with the Client, you have agreed that your technology brief will address the following questions:

The first two questions are mainly for the benefit of Board Members and Managers:

1. What are MANETs, including their potential uses?
2. How does a MANET differ from the Internet and from traditional wireless networks?

The following questions are the main technical topics, which require detailed descriptions:

3. Why is routing in the Internet different to that in MANETs?
4. What are the two main approaches to routing in MANETs and how do they work?
5. What are some of the routing protocols available for MANETs, and what is their current status (standardised? implementations available? research only? considered inefficient?)?
6. Select one of the most prominent routing protocols: how does it work? (give packet/message types, basic procedures, such that Software Engineers at the Client can evaluate the complexity in implementing a routing protocol).

The remaining questions are for all readers, giving conclusions, suggestions for future studies and recommendations:

7. What are other issues should be considered when designing and deploying a MANET?
8. What are the key trade-offs in selecting a MANET routing protocol?
9. Are MANETs are suitable technology for the Client to consider (and what alternatives exist)?

**Topic 2:** Network Mobility Solutions in the Internet**Client:** Public Transport Department**Scenario:**

The Client is a government department responsible for nationwide (as well as city-based) public transport systems. The public transport system includes: busses, trains (above ground and under ground) and boats (e.g. ferries along rivers and within the harbour). The system has extensive coverage within the main cities, as well as between cities and regional centres. A large proportion of the population use the system on a daily basis.

The Client wants to turn their already popular transport system into a world-leading communications network. That is, they would like to provide Internet access to all users on the transport system (for data access, voice/video calls, online interactive applications (e.g. games, promotions), radio and video streaming), as well as use the Internet access for various marketing and control applications (e.g. sending advertisements to the screens in the train, exchanging control and traffic information between vehicles). Various existing and future wireless networks will be used for access: satellite, wireless LAN, Bluetooth, WiMax, 3G, and others. It is intended that in some cases these networks will be specific for the transport system, and in other cases, the vehicles will simply access existing networks (e.g. commercial networks operated by telecommunication companies).

To handle mobility of the individual users and vehicles between networks, the Client understand the basics of Mobile IP, and has heard of NEMO. It is your role to explain NEMO (and other possible mobility solutions)

**Scope:**

After initial project planning and brainstorming meetings with the Client, you have agreed that your technology brief will address the following questions:

The first three questions are mainly for the benefit of Board Members and Managers:

1. What is NEMO, and what is the problem it intends to solve?
2. How can NEMO be used in the Clients transport system?
3. What is the relationship between NEMO and Mobile IP?

The following questions are the main technical topics, which require detailed descriptions:

4. How does NEMO work, that is, how does it solve the problem?
5. What is nested NEMO, and what issues arise compared to ordinary NEMO?
6. What is the status of NEMO?
7. What other options are available to solve the problem NEMO does, and what complementary solutions can be used with NEMO?

The remaining questions are for all readers, giving conclusions, suggestions for future studies and recommendations:

8. What are other issues should be considered when designing and deploying a Network Mobility solution?
9. Is NEMO a suitable technology for the Client (if so, where is it recommended that it could be used)?

**Topic 3: Wireless LANs Deployment****Client:** High Technology Start-up Company**Scenario:**

The Client is a 2-year old company that has had considerable success in biotechnology. Initially operating their business out of university labs and home offices, after receiving significant Venture Capital funding to aggressively grow their business, they have decided to move into a new purpose-built facility that will house: 200-300 employees, laboratories and testing centres, conference rooms, and recreational facilities.

The Client is considering networking options for the new facility. One option, for which they have contracted you to investigate, is that of providing an “all-wireless” network. (This is attractive, because many of the employees are moving between offices and labs, and the layout of labs is often re-arranged). The services that will be provided by the network include: normal office Internet access (web, email, database, instant messaging); voice-over-IP for internal and external phone calls (with option of video calls); transfer of experimental data (e.g. high quality images and video, very large data sets); control of devices used in experiments; security footage and others.

The Clients wants to know whether an “all-wireless” network, using wireless LAN technologies is possible, and what are the technical options. Note, by “all-wireless” it means the clients access via wireless – it does not prohibit a wired network within the facility (such as between access points, servers, Internet connections).

**Scope:**

After initial project planning and brainstorming meetings with the Client, you have agreed that your technology brief will address the following questions:

The first three questions are mainly for the benefit of Board Members and Managers:

1. What is a Wireless LAN?
2. What are the advantages and disadvantages of using wireless LAN for the entire network?

The following questions are the main technical topics, which require detailed descriptions:

3. What are the differences between the different wireless LAN standards (a, b, g, n) and can they support the applications necessary for the Client?
4. Are there techniques for giving priority to certain traffic in the network, that is, quality of service?
5. Are there techniques for securing the network traffic?
6. What is the status of the solutions from the above points, with respect to standardisation, implementation, availability, future use?

The remaining questions are for all readers, giving conclusions, suggestions for future studies and recommendations:

7. What other technologies could be considered for an “all-wireless” network, or even a network that mixes wired access with wireless access?
8. Is an “all-wireless” network a suitable option for the Client?

**Topic 4: City-Wide Wireless Mesh Network****Client:** Internet Service Provider**Scenario:**

The Client is a small start-up company that aims to be an Internet Service Provider (ISP) across a large metropolitan area. The aim to differentiate themselves from the many other ISPs by: 1) owning and operating their own wireless backbone network across the city; and 2) offering wireless access to customers. This approach allows the ISP to avoid installing expensive wired network across the city, or leasing wired network capacity from other ISPs. The Client has an agreement with several companies (such as 7-Eleven) to obtain physical access to buildings to deploy wireless access points. The intention is to provide wireless access to customers from these locations, as well as transport traffic between buildings via wireless, back to one or several gateways owned by the ISP. That is, a multi-hop wireless or mesh network. For example, a wireless hop from customer to building, then several wireless hops between buildings until finally the gateway is reached.

The Client wants to know the technology options for deploying this city-wide mesh network.

**Scope:**

After initial project planning and brainstorming meetings with the Client, you have agreed that your technology brief will address the following questions:

The first three questions are mainly for the benefit of Board Members and Managers:

1. What is a wireless mesh network?
2. What are the advantages and disadvantages of using wireless mesh network for coverage of the city (as opposed to building own wired network, or leasing wired connections)?
3. Are there wireless mesh networks in use (or planned) today? (give some examples)

The following questions are the main technical topics, which require detailed descriptions:

4. What wireless technologies can be used for the customer wireless access?
5. What wireless technologies can be used for the wireless backbone network between buildings and back to the gateways? Does it have to be same as the customer wireless access?
6. What are the implications of using multi-hop wireless networking with respect to routing and performance?
7. What is the status of the solutions from the above points, with respect to standardisation, implementation, availability, future use?

The remaining questions are for all readers, giving conclusions, suggestions for future studies and recommendations:

8. What other technologies could be considered for the ISP network?
9. Is a wireless mesh network a suitable option for the new ISP?

**Payment:**

The payment terms (i.e. your marks) are as follows:

- **Presentation:** You must produce a professional looking brief, making good use of sections, clear illustrations and tables and good English.
- **Technical accuracy:** The things you say must be accurate/correct.
- **Coverage and depth:** You must provide sufficient coverage of the topic (e.g. identify and discuss the relevant issues, answering all the questions)
- **Quality:** an overall judgement on the usefulness of the brief, e.g. providing the right level of detail for the audience, using appropriate resources (e.g not just re-writing a Wikipedia page, but getting information from multiple sources) and so on.

As there are at least 4 people consulting on the same topic, comparisons between the different briefs will be made. That is, you are competing against the other people with your topic, as well as against the other topics.

**Topics:**

This is individual work! Each person must do their own research and produce their own, independent technology brief on the topic listed. Any obvious “similarities” will be penalised, as will plagiarism from web sites, textbooks etc.

Rangsiman Tritipchartsakul	City-Wide Wireless Mesh Network
Nitinat Jirattikanchote	City-Wide Wireless Mesh Network
Apinat Sopitkunanant	City-Wide Wireless Mesh Network
Nuttapon Pichetpongsa	City-Wide Wireless Mesh Network
Surasit Patana-anek	City-Wide Wireless Mesh Network
Sake Valaisthien	Network Mobility Solutions in the Internet
Phuviwats Leevoraphanchai	Network Mobility Solutions in the Internet
Warakorn Gulyanon	Network Mobility Solutions in the Internet
Napatsorn Mekarporn	Network Mobility Solutions in the Internet
Swit Phuvipadawat	Routing in Mobile Ad Hoc Networks
Tanit Supworakhun	Routing in Mobile Ad Hoc Networks
Tavicha Ruangnukulkit	Routing in Mobile Ad Hoc Networks
Hathaikan Petchphiboon	Routing in Mobile Ad Hoc Networks
Rathanin Wujchalapong	Wireless LANs Deployment
Kitthidet Lohaset	Wireless LANs Deployment
Ram Pakchokdee	Wireless LANs Deployment
Pharanyu Sornsuwan	Wireless LANs Deployment