

ITR-4

4th Infocomm
Technology
Roadmap
Seminar

iDA

INFOCOMM
DEVELOPMENT
AUTHORITY OF
SINGAPORE

Infocomm Landscape - A Long-Term Perspective

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26 November 2002

collaborate

communicate

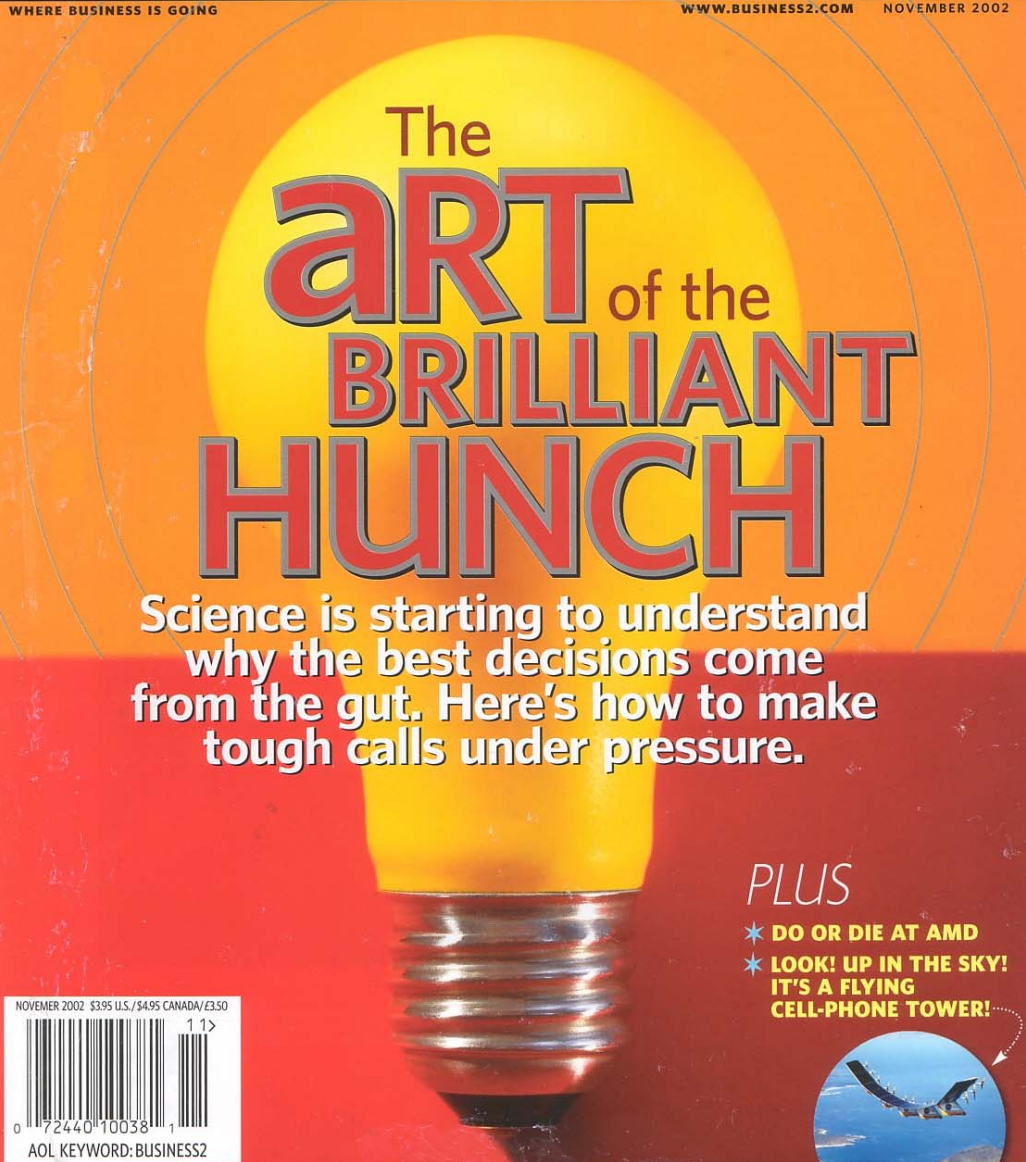
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Outline

- IT tidal waves
 - XML/Web Services
 - Open Source Software

- Communication tidal waves
 - Ultra Wide Band (UWB)
 - Ad hoc networking

- Conclusion

Technology Bets



Next Generation Internet Applications (NGIA)

- Grid Computing (Host – Host)
- Web Services (Server – Server)
- P2P (Client – Client)

Wireless Comm

- UWB (WPAN) - Piconet
- 802.11b (WLAN) - Micronet
- 802.11a, g, (NG WLAN)
- 3G/4G (WWAN) - Macronet

Wireline Comm

- 10-Gigabit Ethernet/
Optical Networking

Security

- iSecurity (Cryptography,
Biometrics, Smart Card)

Two Tidal Waves on the IT Horizon

- XML/Web Services
- Open Source Software



What is XML?

- eXensible Markup Language (XML)
 - A simple flexible text format to describe data
 - Data are wrapped in "tags" according a Document Type Definition (DTD) or "schema"
- Example of an XML document describing a book
 - `<?xml version="1.0"?>`
`<Book>`
`<Title>.NET Framework Essentials</Title>`
`<Author>Thuan Thai</Author>`
`<Publisher>O'Reilly</Publisher>`
`<Year>2002</Year>`
`<Edition>Second</Edition>`
`<ISBN>0-596-00302-1</ISBN>`
`</Book>`

What is a Schema?

- Example of a schema about an XML for book

```
<?xml version="1.0">
<xsd:schema id="Book" xmlns=""
  xmlns:xsd=http://www.w3.org/2001/XMLSchema>
  <xsd:element name="Book">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="Title" type="xsd:string" />
        <xsd:element name="Author" type="xsd:string" />
        <xsd:element name="Publisher" type="xsd:string" />
        <xsd:element name="Year" type="xsd:string" />
        <xsd:element name="Edition" type="xsd:string"
          minOccurs="0" />
        <xsd:element name="ISBN" type="xsd:string"
          minOccurs="0" />
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```

Why is XML important?

- Simple, self-describing, open, easily processed by machines
- eXtensible by virtually limitless addition of tags
- Platform independent and enables data portability
- Schema itself is an XML document!
- Data exchange standard on the Web
- Suddenly whole world is talking about XML!

BUT..

- Needs agreement on the schema, the protocol, business process, etc.
- Standards are being defined
- Lacks semantic information for computer to understand

What is XML-based Web Services?

- Self-describing, loosely coupled software components to enable services that can be published, discovered, and invoked over the network based on open standards
- Manifestation of how XML technology is leveraged to achieve application to application solution
 - XML-based SOAP protocol for messaging
 - XML-based WSDL for service description
 - XML-based UDDI for service publication
- Is it a hype? Yes in some ways. But here to stay. Garnered greatest support from industry and academia alike in the world of distributed computing

Looking ahead...



XML and Web Services will be the
key building blocks & enabling technologies
for

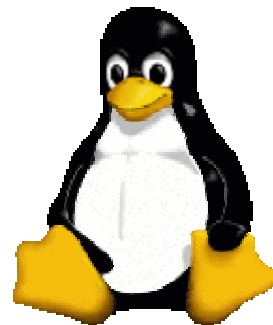
Next Generation Internet Applications



What is OSS?


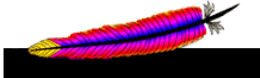




- Open Source Software (OSS) is software with the source available that may be freely used, copied, and distributed with or without modifications, and that may be offered either with or without a fee.
- Free as in “freedom” -- not “free of charge”.
 - Internet Explorer is “free of charge”, but users have no “freedom” to change it.



Successful OSS Stories



- Internet
 - Majority of the core protocols of Internet are Open Source, e.g. BSD Socket and Domain name server.
- World Wide Web
 - Open Source Architecture, e.g. http.
 - Open Source Browser -- Mosaic
- Linux (30% server market - IDC) 
- Apache (60% web server market - Netcraft) 
- MySQL (10% database market - Bloomberg) 
- Perl/PHP (24% web content market - Netcraft) 

*Can you see the **LAMP?***

Why OSS?



- Ability to harness the collective innovation of thousands of individuals to create and improve on the software
- Development of indigenous software community
- Keep the software industry on their toes
 - Come out with better product, or risk losing customers
- Cost Savings

Linux vs. Windows The Bottom Line



	Microsoft Solution	Linux/Open Source Solution
Companies with 50 users	\$69,987	\$80
Companies with 100 users	\$136,734	\$80
Companies with 250 users	\$282,974	\$80

- Based on Cybersource@2001. All values in US\$.

Some issues to consider



- Interoperability with existing environment (you already are a hostage!)
- Users resistance to change (used to look and feel)
- Customization for new features
- Training and support

The road ahead...



- OSS is unstoppable on the server market.
- OSS on desktop is still too early to call. But the maturity in many of the OSS desktop applications (such as Open Office & Mozilla) start to attract more users.
- *"We certainly accept free software as part of the software ecosystem. In fact, there's a very virtuous cycle where people do free things, ... And so you see the free software and the commercial software existing together.."* - Bill Gates at TechEd 2001 Conference

Two Potentially Disruptive Communication Technologies

- Ultra-Wideband



- Ad Hoc Network

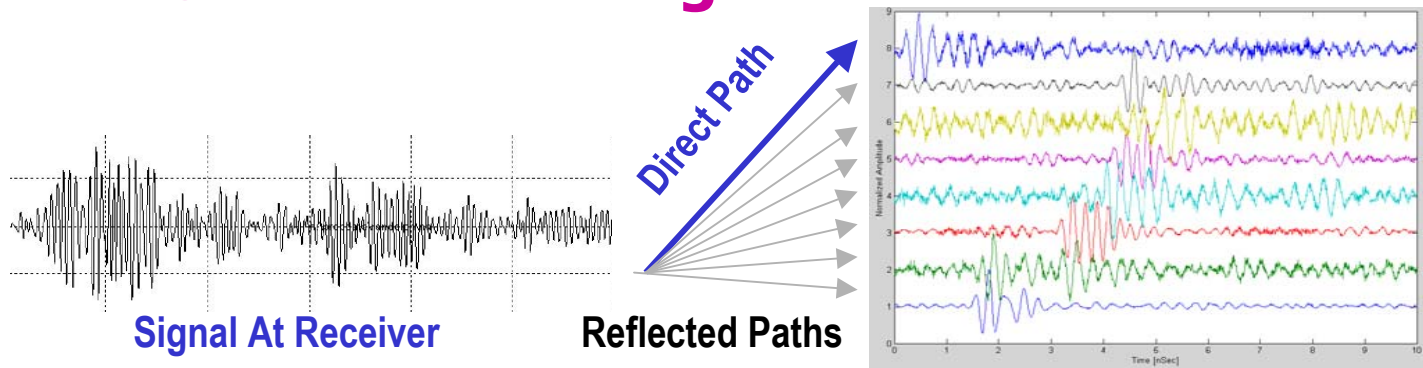


What is Ultra-Wideband (UWB)?

- Evolved from over 30 years of R&D under classified military programmes
- Communication using **very short pulses** lasting a fraction of a nanosecond each
 - Signal is low power and noise-like
 - Cuts across GHz of frequencies
- Calls for a **paradigm shift** in the way we manage spectrum resources
 - Very wide bandwidth of the UWB signal means it's not possible to allocate frequencies specifically for UWB
 - Forces the regulator to think about **frequency sharing**
- Major players looking into UWB
 - Intel, IBM, Philips, Siemens, Sony, Texas Instruments...

The UWB Signal

- Each pulse carries a binary 1 or 0, which can be represented by
 - Delaying or advancing the pulse
 - Flipping the pulse (phase change)
 - Other new modulated schemes are being developed
- At the receiver, these pulses will appear alongside copies of themselves caused by **reflection** off obstacles
 - Pulse copies can be offset in time and used to **reinforce the main signal**



The UWB Advantage

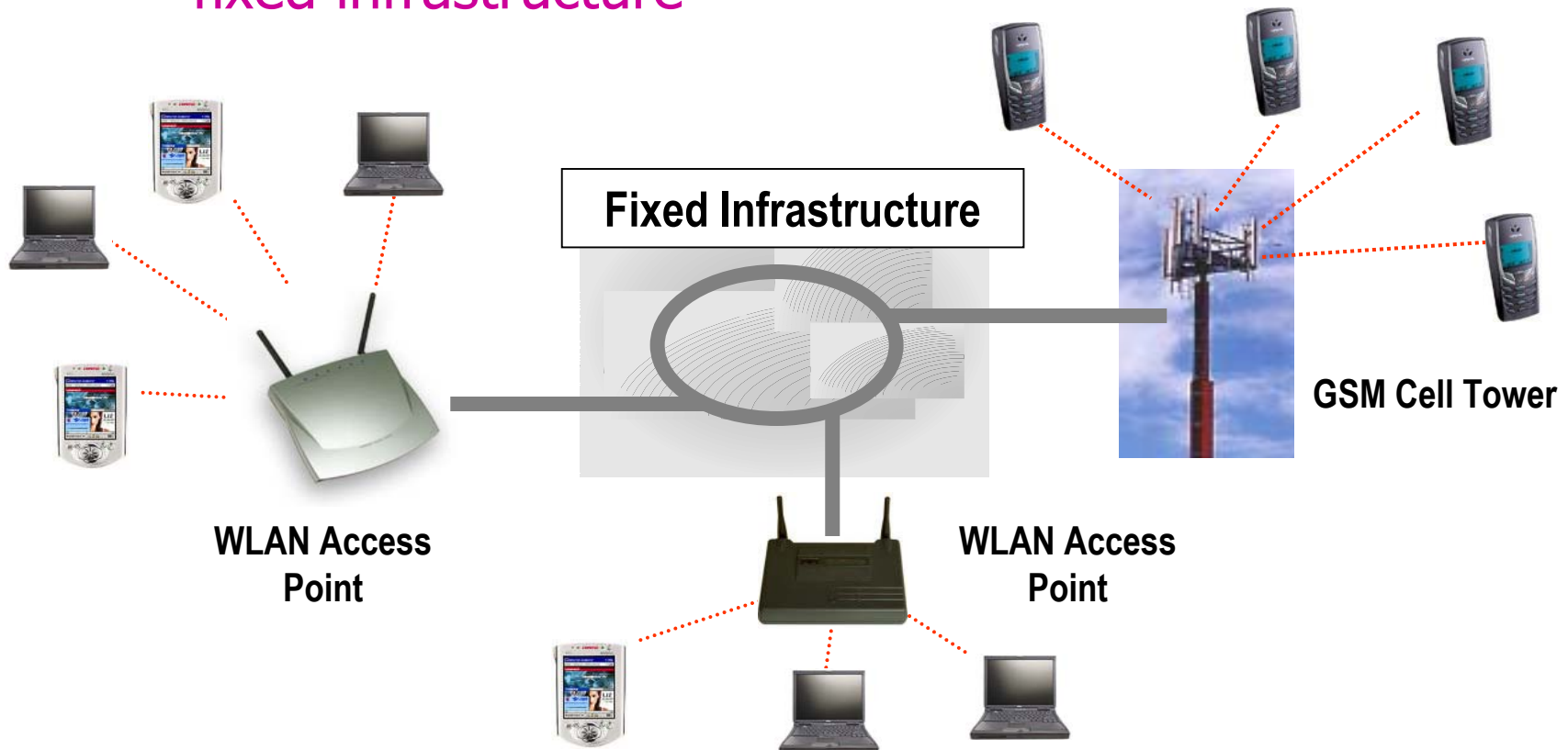
- Compared to other wireless technologies, UWB offers **higher data rates** at a **low cost** with **low power consumption** requirements
- Ideal for portable wireless consumer devices

	Max Data Rate	Max Range	Cost Per Chipset	Max Power Consumption	Bandwidth	Spatial Capacity
Bluetooth	0.72 Mbps	10/100 m	US\$5	200 mW	1 MHz	1 kbps/m ²
WLAN 802.11b	11 Mbps	100 m	US\$20	2000 mW	20 MHz	30 kbps/m ²
WLAN 802.11a	54 Mbps	30 m	US\$25	2000 mW	20 MHz	83 kbps/m ²
UWB	>100 Mbps	10 m	US\$19.95	200 mW	>1000 MHz	>1000 kbps/m²

Initial offer price for sampling. Price target is **US\$5-8**

What We're Doing Today

- The **base station–mobile terminal** approach
 - Mobile terminals communicate only with a base station
 - Data is transported between base stations across some fixed infrastructure



What We Can Do Differently

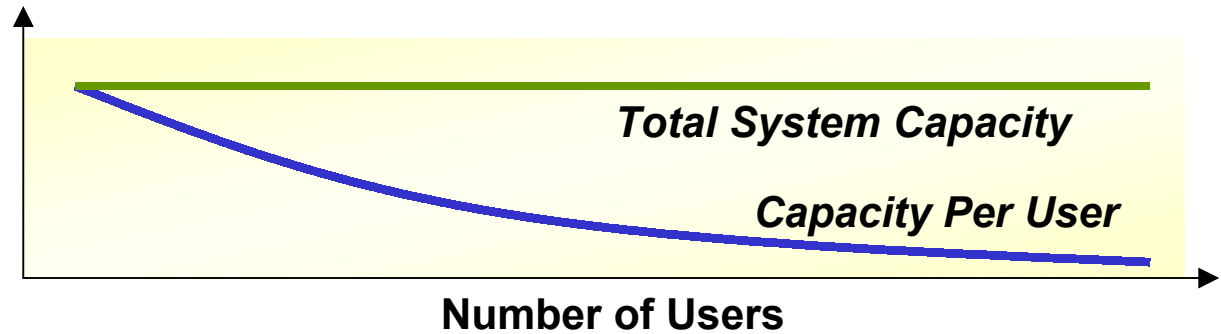
- Ad Hoc Networking
 - An means of allowing wireless devices to maintain connectivity with one another that is:
 - **Decentralized** – no external infrastructure
 - **Autonomous** – self-organizing, self-healing
 - Every terminal is capable of serving as a **relay** between two distant devices wishing to communicate
 - Each terminal is now a base station as well!



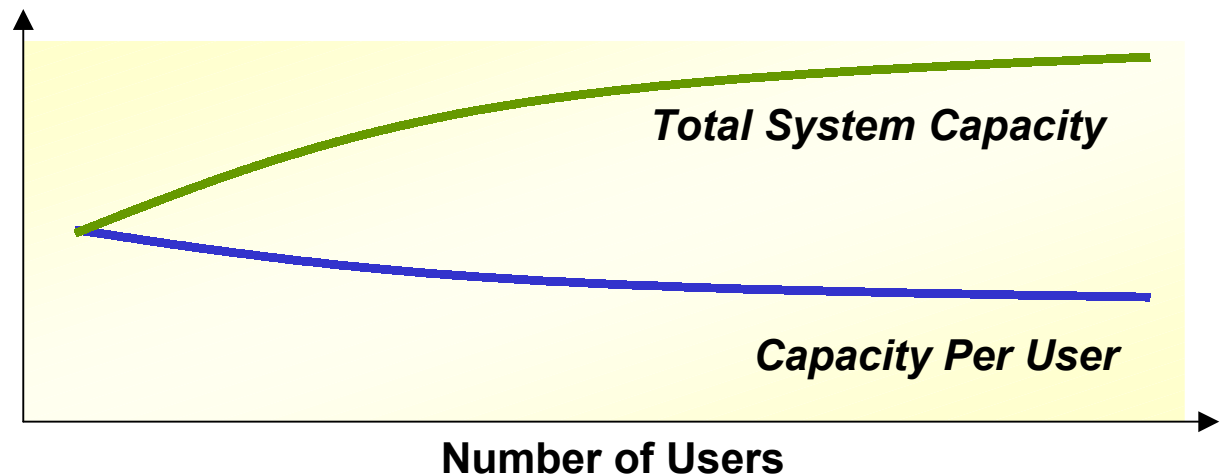
Why Go Ad Hoc?

- With **Ad Hoc Networking**, each mobile terminal is also a base station
- System capacity grows as the number of users grows

The
“Conventional”
Approach



With Ad Hoc
Networking
*Spectrum scarcity
issue resolved?*



Unresolved Issues

- **High latency** due to multiple wireless hops
 - May be unsuitable for real-time applications
- **Lack of widely adopted standards**
 - Ad hoc networking will take off only if devices are ubiquitous and are all using the same protocols
- **Data security** must be addressed
 - A device acting as a relay will be listening to and processing data packets that belong to others
- **Power management**
 - Ad hoc devices transmit even when not being used
 - Need to serve as a relay to neighbouring nodes
 - But transmission power can be kept low if the neighbours are close by

Conclusion

- XML – A new and flexible way for organizing and exchanging data
 - XML-based Web Services – A new and dynamic way of integrating services on the net
- Open Source Software – Leverage the mass innovation in the open
- Ultra Wide Band – A new paradigm in managing spectrum allocation
- Ad Hoc Network – A new economic model for wireless services

We want to hear from you,

Send us your
Technology Suggestions
via our new online technology assessment
form at ...

www.ida.gov.sg
and click on menu
"Technology
Development"

The screenshot shows a web browser window displaying the IDA Singapore website. The page title is "Industry Technology Suggestions". The form includes fields for Name, Title, Company or Organisation, and Email. Below these is a section for "Technology that you wish to highlight to us" with a dropdown menu and a "Comments about this technology" text area.

Below the form is the "Online Technology Assessment Form" section, which includes the following text: "The following multiple choice questions are optional." This is followed by two tables of questions and remarks.

Questions/Ratings	Remarks
What is the projected growth rate for this market? <input type="radio"/> Low <input type="radio"/> Medium <input type="radio"/> High	State source of information (e.g. Gartner, Ovum, IDC, Forrester, etc).
What is the projected global market size in 5 years? <input type="radio"/> Small	State source of information and estimated figures in US\$.

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