

NORTEL NETWORKS

How the world shares ideas.

High Speed PowerLine Networks

*...a major new consumer data opportunity
for our National Advancement*

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Overview

- **Introduction**
- **Market Drivers**
- **Issues/Solutions to Power Line Communications**
- **Current Power Line Market Status**
- **The Services Opportunity Unfolds**

Introduction

- Powerline based networks are highly viable, even a preferable medium.
- Powerline based high speed data systems are being rolled out NOW over Utility and Home Wires.
- With leadership from the FCC and UTC, investment can be accelerated into the Americas for powerline networks.



Power Line Evolution

- **Established Niches over a decade:**
 - PowerLine based systems began over a decade ago for control systems, truck and shipboard monitoring of goods.
 - CeBus standard delivered control systems for low bit rate appliance control
- **Moore's Law offering improved DSP and modulation techniques to handle noise**
 - Speeds up to 356 kbps in home systems and 100kbps shipboard systems
 - Speeds up to 1000 kbps in Access to the home in Europe
- **Next Generation:**
 - 2-10 Mbps over useable spectrum for both in home and access to the home in the course of 12-18 months.
 - Market space greatly expands to include IP appliances, IP Voice, High Speed Access with In Home LAN's

The Reference Point - Access

Rest of World

- Advancements in powerline access protocols offered opportunity for UK and Europe to move.
- Dense homes/transformer drove market introduction.
- Systems deep in trials with systems in UK, Europe, and Asia for access to premises with major utilities covering >50million power users.
- North America has a newer infrastructure with strong growth that is seeking an alternative connection.

Growth is occurring via powerline data in EU, Asia, and UK
USA would be able to benefit from this experience

The Reference Point - In Premise

USA

- Multiple PC/Printer homes hit the 20 million mark
- Demand for high bandwidth services extends into and around the home/SOHO to minimize cost
- Powerline systems at 356kbps in stores in 1998 and offer the reuse of wire every 6 feet
- Powerline systems in use in trucking industry and shipping industry at sub 100kbps
- Next generation of systems drive to 10 mbps levels

Activate multimedia services

PowerLine WAN/LAN

Delivering Value Add

The Access

“Continuous Delivery of a Commodity Service to a Premise”



“The continuous Delivery of Services to a premise that accelerates End User access to high speed content, education, and experiences”

The Premise

“Discreet use of a high speed connection”



“Home networks linked to deliver cost saving and services to add value to our lifestyles”

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- **Market Drivers-Access**
- **Market Drivers-Premise**
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- **The Services Opportunity**

The Market Drivers - Access

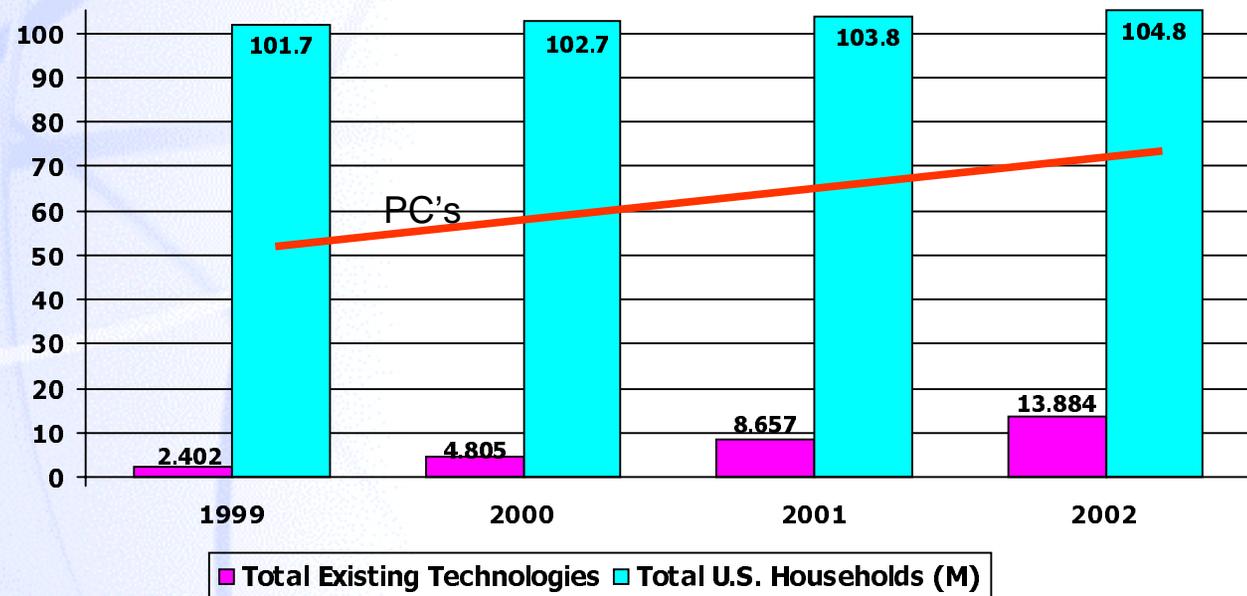
- **END USER** seek appliance-like low-cost, high speed and easy access to Internet
- **ISPs** seek new high-speed access solutions driven by global growth of data services
- **POWER UTILITIES** seek new revenue opportunities presented through deregulation
- **GLOBAL CARRIERS** seek alternative access over Telcos and CATV operators
- **GOVERNMENT** seek to bring new competition and options to the consumer base



U.S. Residential High-Speed Internet Access

Addressable Market

1999-2002 (M)



Total Existing Technologies: ISDN, Wireless, DSL, Cable modem, Satellite.

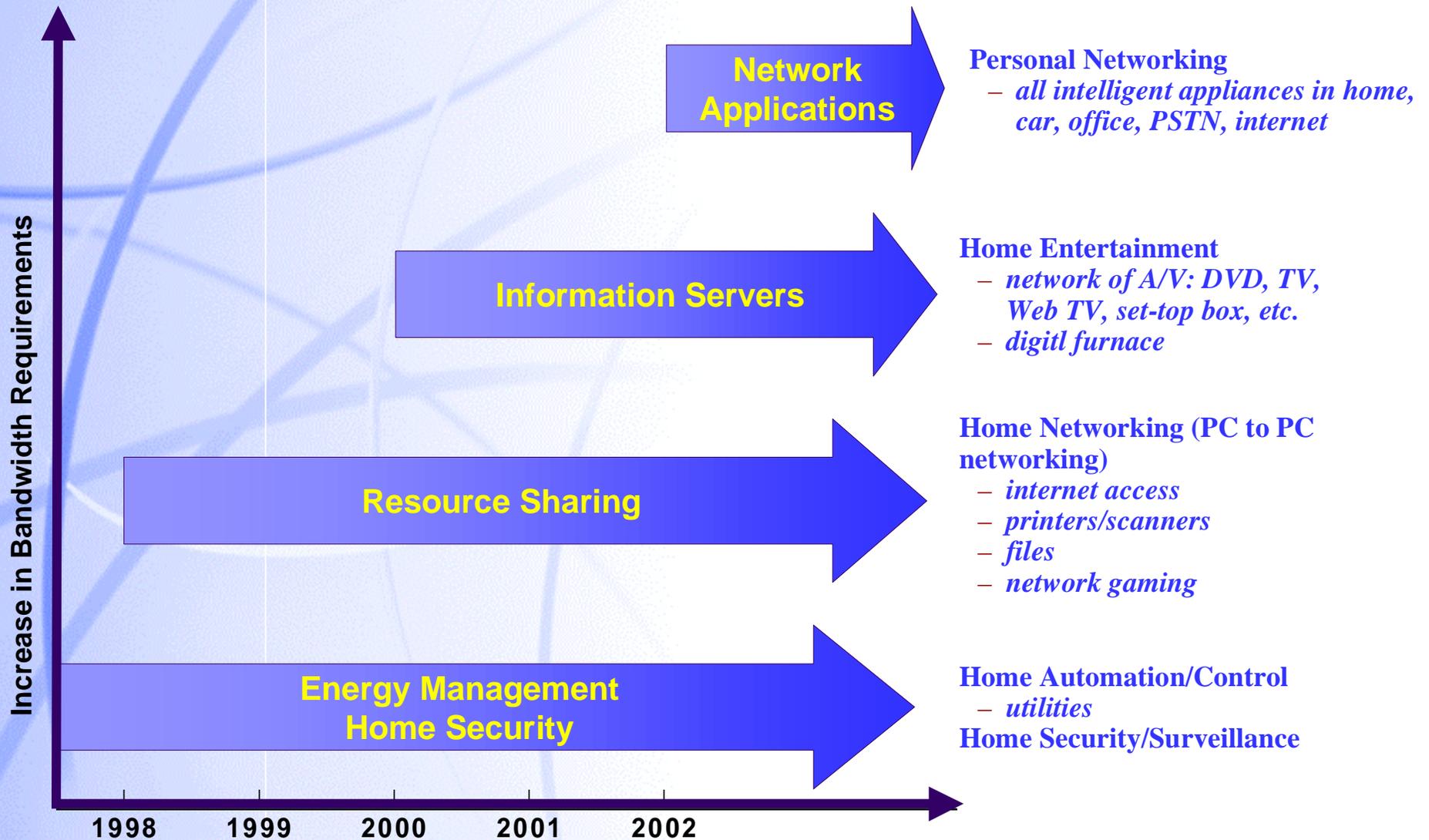
Source: International Data Corporation, September 1998

The Market Drivers - Premise

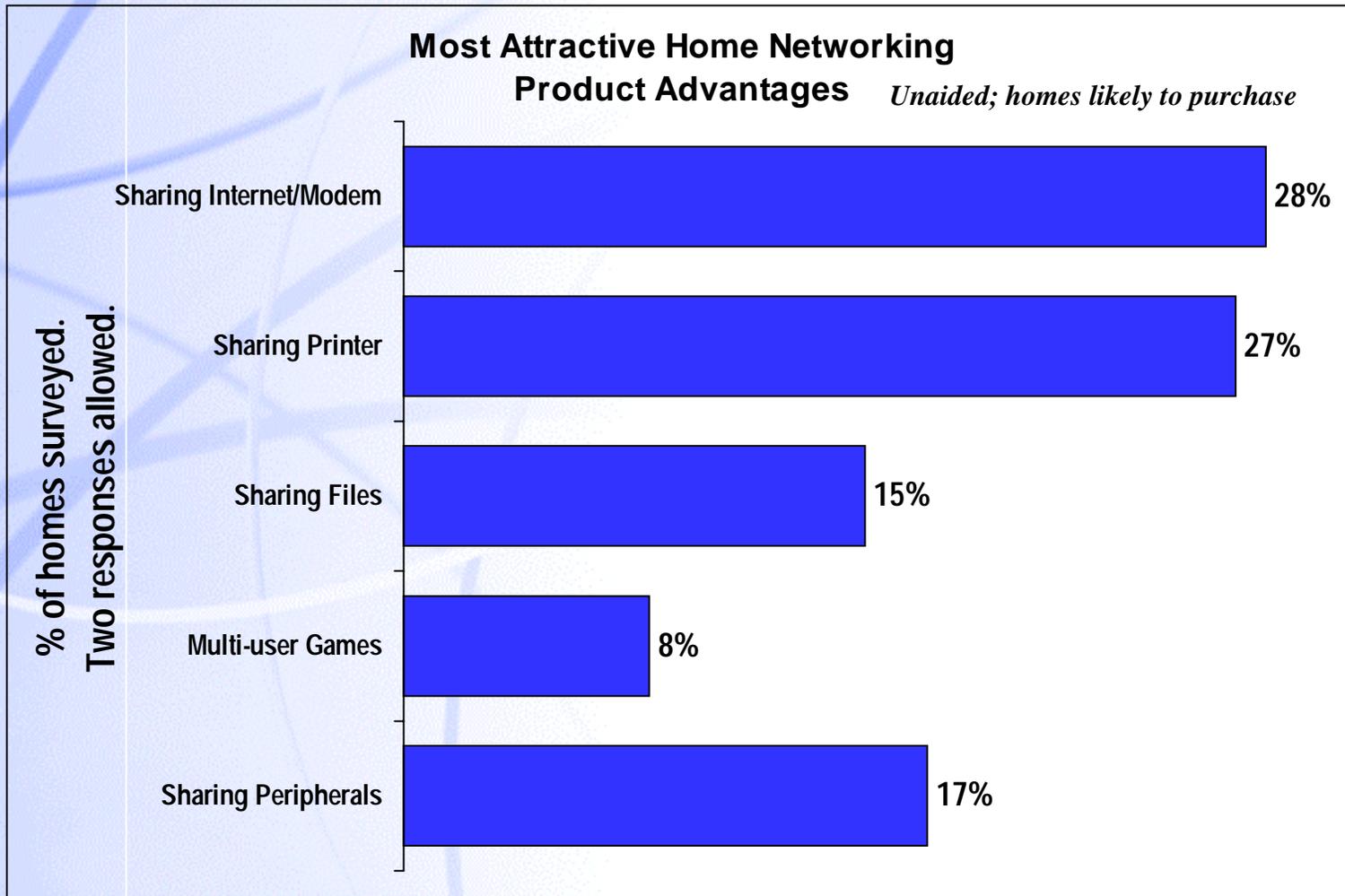


- **END USER** seek appliance-like low-cost, high speed and easy access to Internet *that is shared amongst devices (ie one HS modem per home)*
- **ISPs** seek new high-speed access solutions driven by global growth of data services *and throughout the premise to new IP devices*
- **POWER UTILITIES** seek new revenue opportunities presented through deregulation *by leveraging their image into the home space.*
- **GLOBAL CARRIERS** seek alternative access over Telcos and CATV operators *and VoIP.*
- **GOVERNMENT** seeks to bring new competition and options to the consumer base
- **INDUSTRY** *seeks to fill in the missing link - the LAN to enable IP based devices investment*

Home Networking Evolution



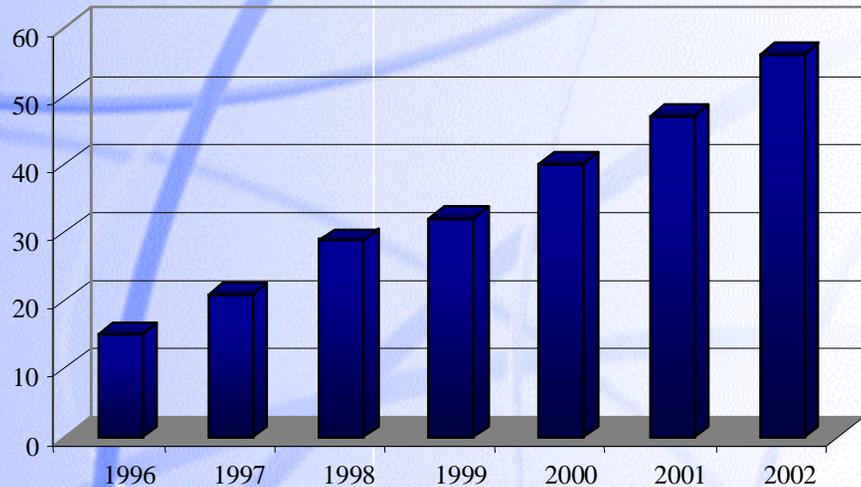
Today's Key Drivers



Key Market Trends In the Home

Millions of Households

U.S. Online Households

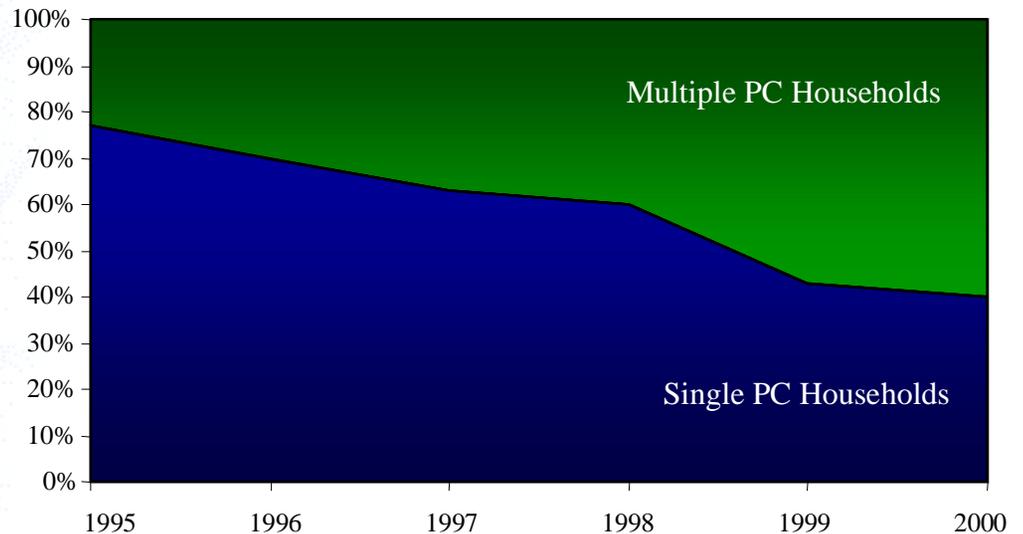


- One-third (30M) of US households have Internet access devices including PCs
- By the year 2002, 15.3M households will depend on their in-home networking connections to enable communications between multiple PCs and other electronic devices

Households are Racing Online . . .

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Drop in First Time PC Buyers, Multiple PC Households Growing



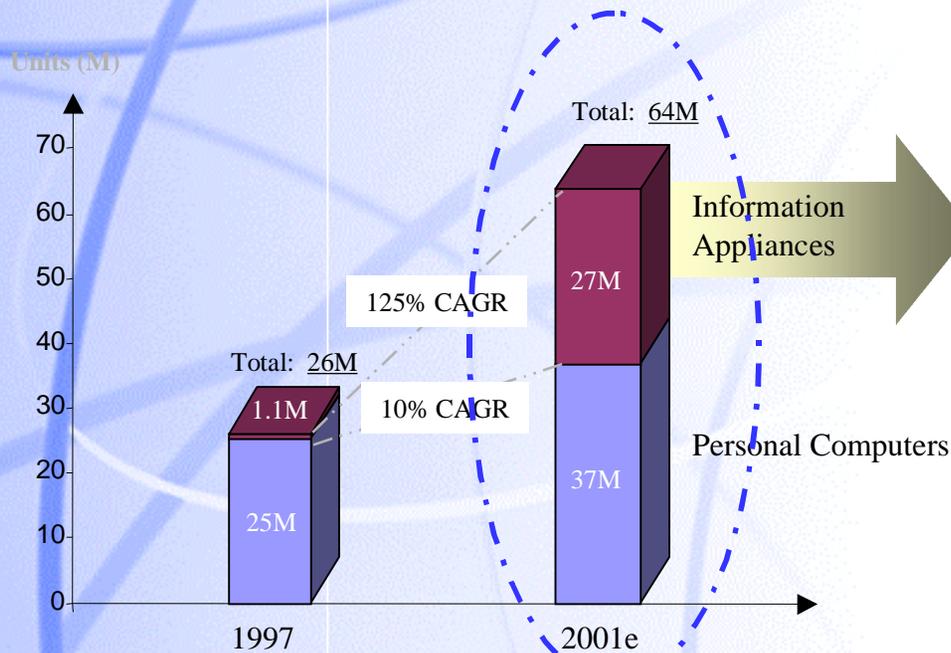
- Over 15 million of the nearly 100 million homes in the United State have two or more P.C.s
- This number is growing 30% annually

. . . And increasingly on Multiple PCs

Source: Jupiter Communications
DJM-4/9913

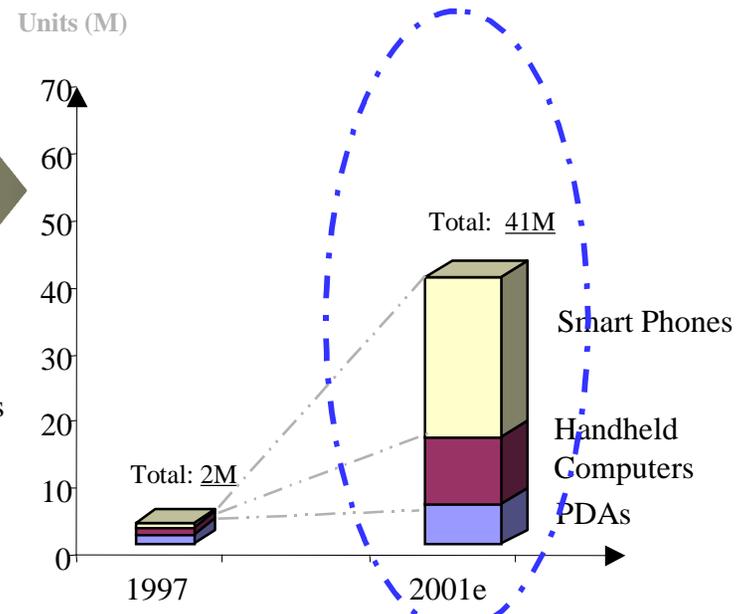
Intelligent Devices - 2001 Market Opportunity

Total Devices



Source: IDC

Emerging Devices



Source: Datacomm Research Co.

Over 100M Intelligent devices requiring greater connectivity

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Current Electricity Networks - Access

- **Most Ubiquitous Coverage of any media**
- **Delivers commodity services - always on**
- **High Reliability within the neighbourhood and home**
- **Capable of delivering > 1 MHz high-speed data without impacting current services**
- **Rural and Urban and Suburban networks have opportunity to become data pipes**

High Speed Data Over Power Line

Technical Challenges:

- Coexistence of the data signals and the electric current.
- Identify and quantify issues with RFI regulations.
- Protecting the data signal from electrical noise.
- Current data services' speed and capacity.

Technical Solutions:

- Operating data signals at > 1 MHz.
- High efficiency coupling plus low signal power combine to satisfy RFI regulators.
- Unique protocol/modulation scheme that avoids the power noise.
- Next generation modulation techniques on a chip.

Next Generation Keys

- Improved modulation and protocols as industry learning occurs.
- Improved regulations on emissions to a reasonable level that still avoids interference.
- Linkage of Access with In Home LAN to create interoperability standards.
- Acceptance by Industry as a viable first mile solution that drives new services and is allowed under regulation.

Current Electricity Networks -In Premise Advantages

- **Access Points every six feet**
- **Appliances all require placement at socket**
- **Ease of access at home entry point for HS Access**
- **Control systems and energy devices are all linked to power system**
- **New Internet devices will all be powered**

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European Status PowerLine Based Communications

Global Utilities Adopting PowerLine Communications

SYDKRAFT

THE ENERGY COMPANY FOR THE NEW ERA

EDON

NORWEB
communications
a United Utilities company

AEM SPA

RWE Die Zukunftsgruppe.

Stockholm Energi

VATTENFALL

EnBW

These utilities reach **35,000,000** power users.

Inaugural Trial Deployment



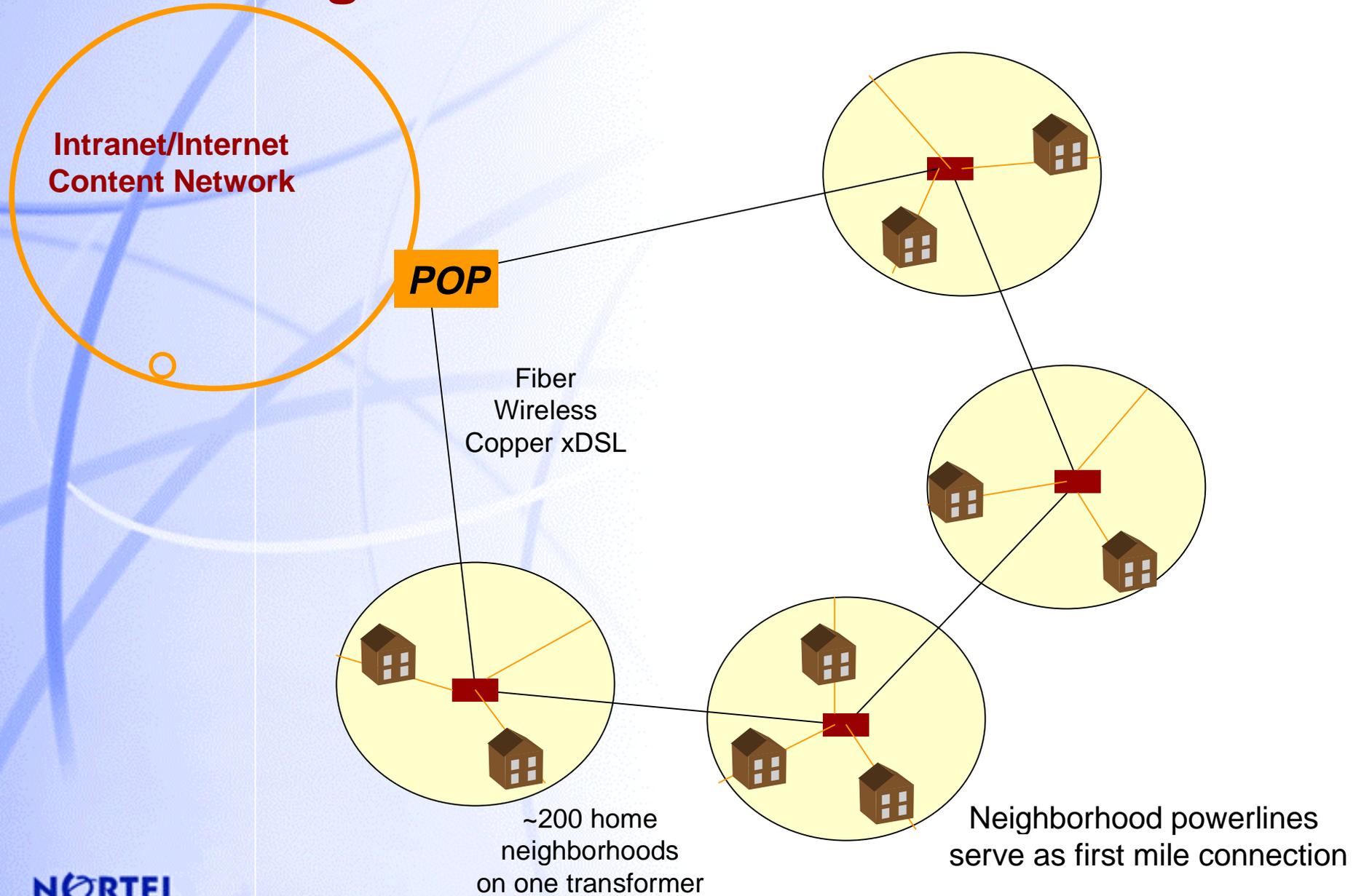
Trial Area: Manchester UK

Community Value

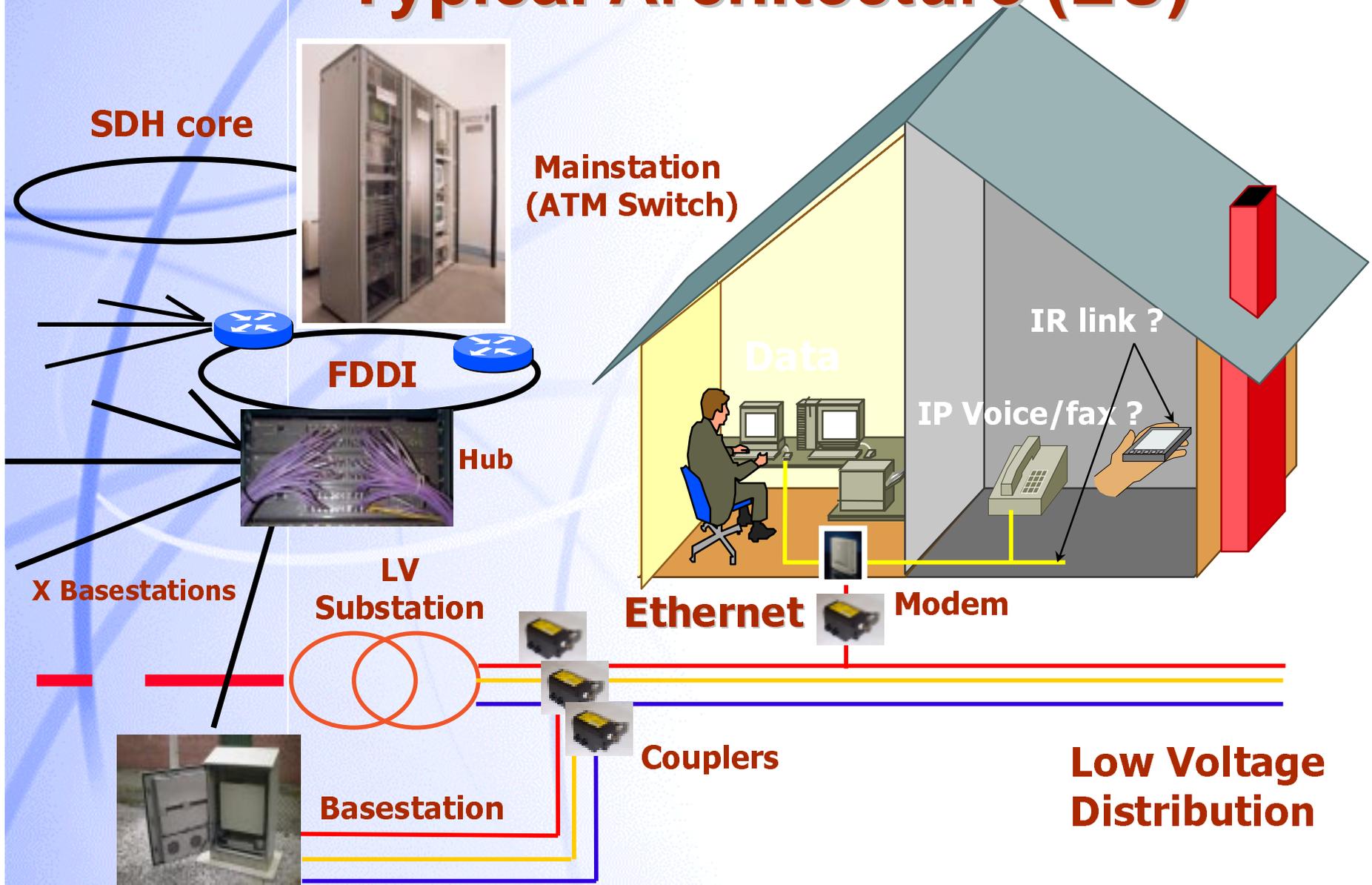
**Headmaster, Elementary School in Manchester, England
Utilizing a PowerLine based network since end of 1997**



High Level Architecture View



Typical Architecture (EU)

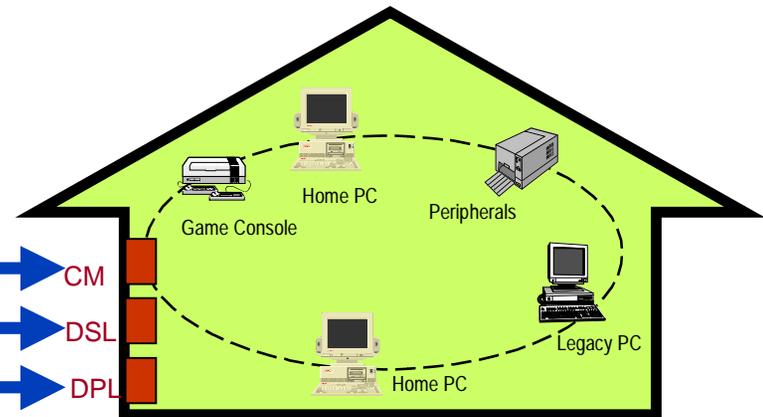


North America Status

North America Market Status

- Industry is prime for new alternative to reach the consumer to serve demand for high speed access.
- FCC's interest in establishing the correct Part 15 limits is key to investment by the industry.
- In Home LAN's are in the market at 100 and 356kbps speeds in the retail space
- Next generation multimeg LAN solutions in the market in less than 12 months for trials/early retail.

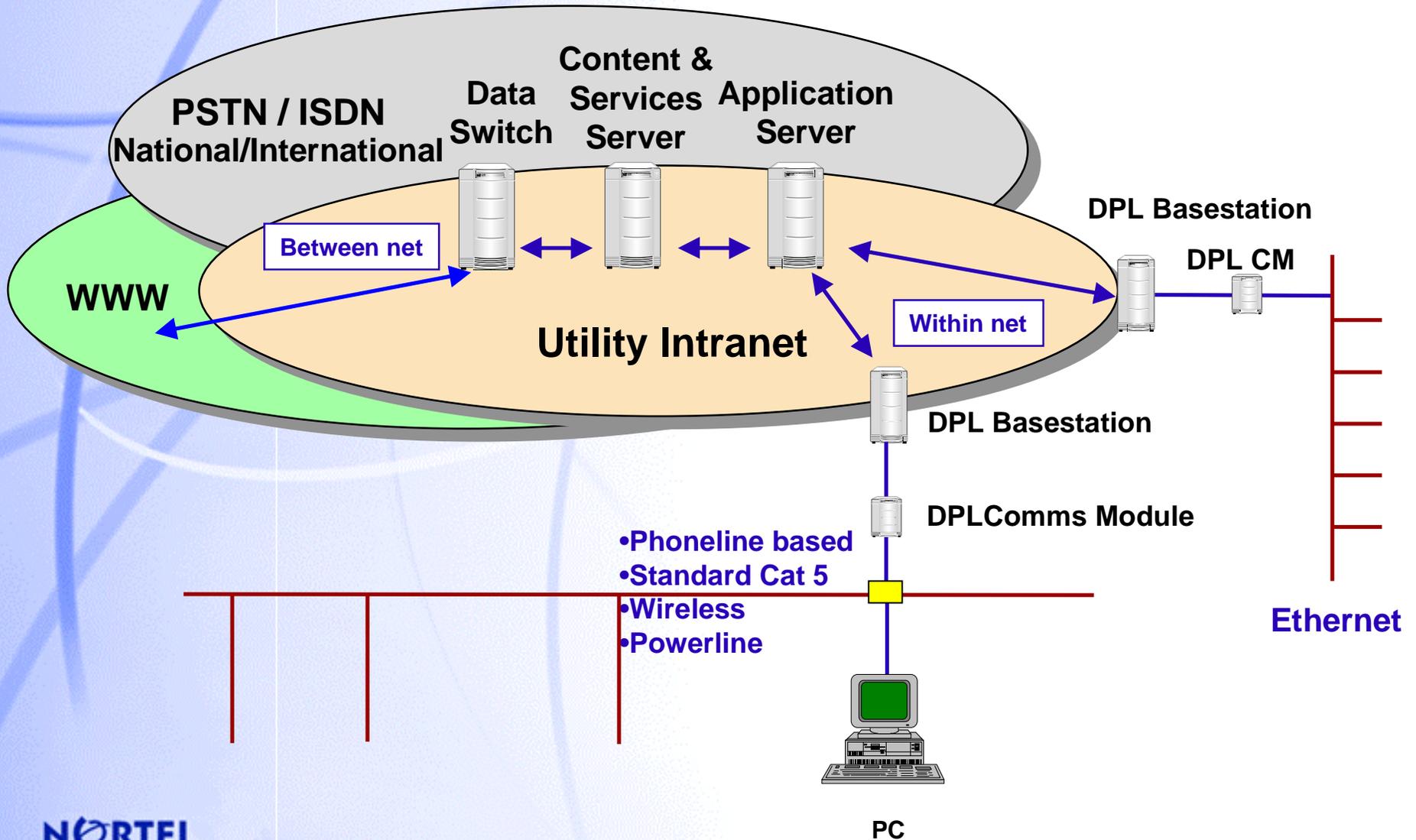
Content/Apps/Services



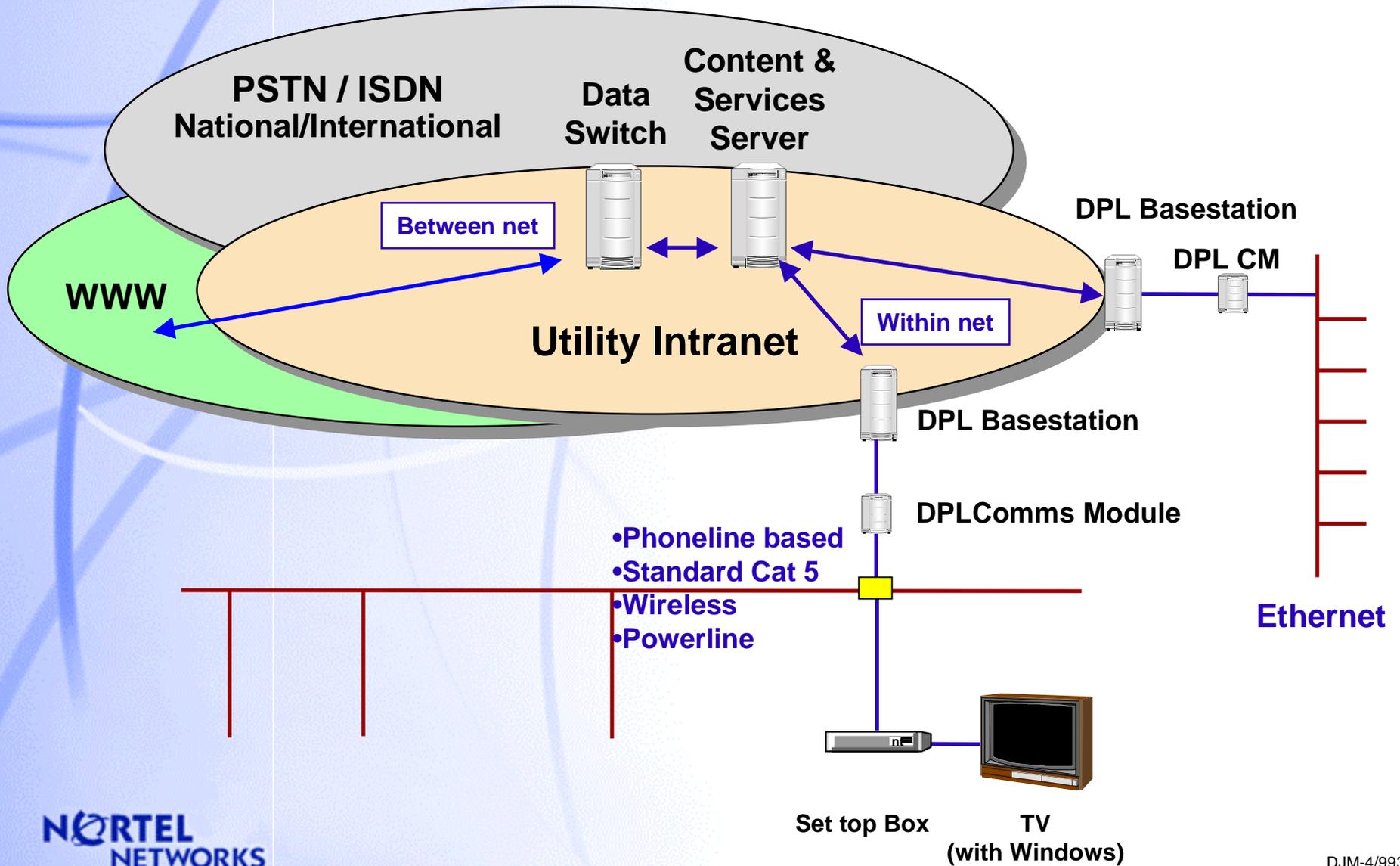
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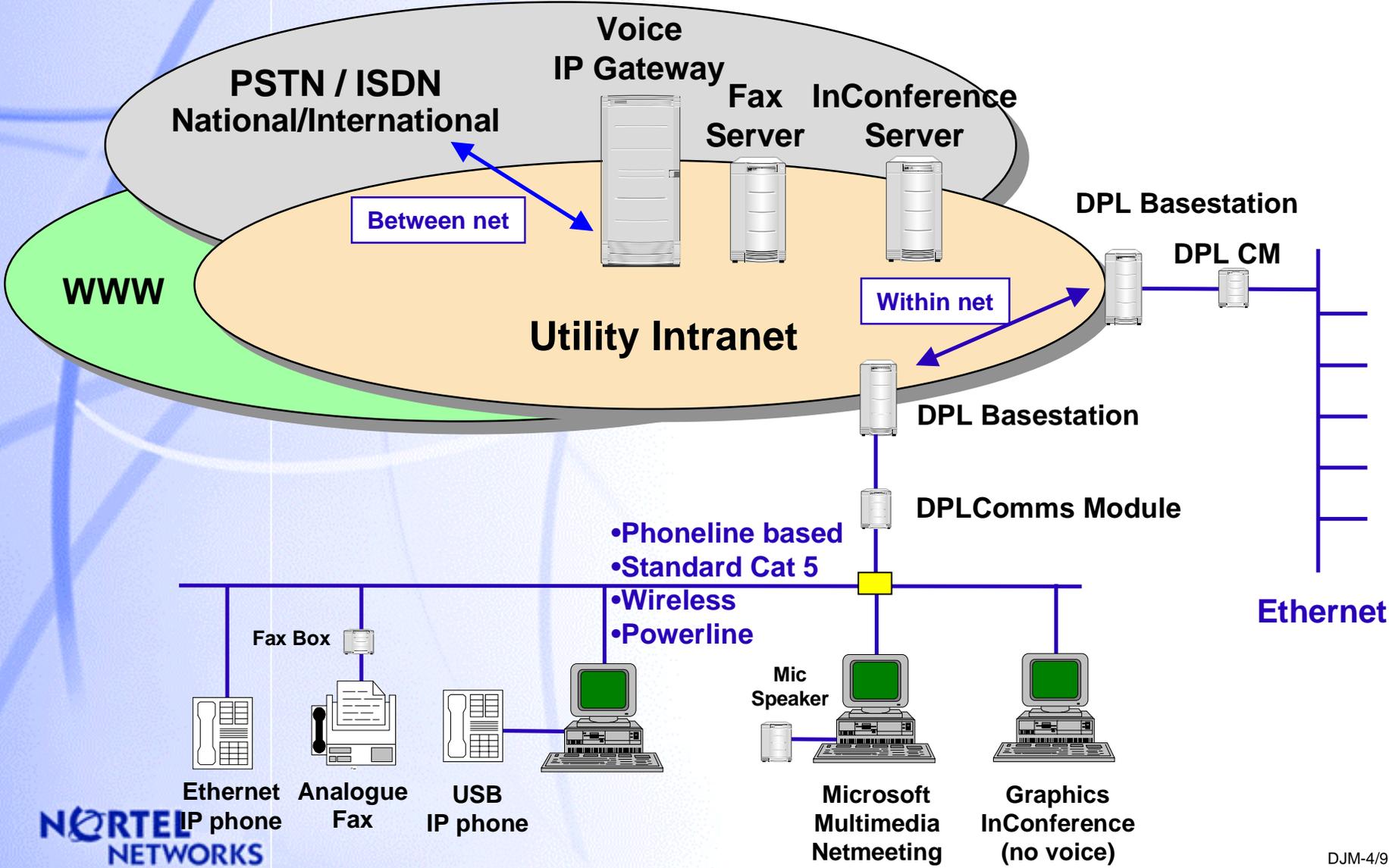
Single High Speed Connection



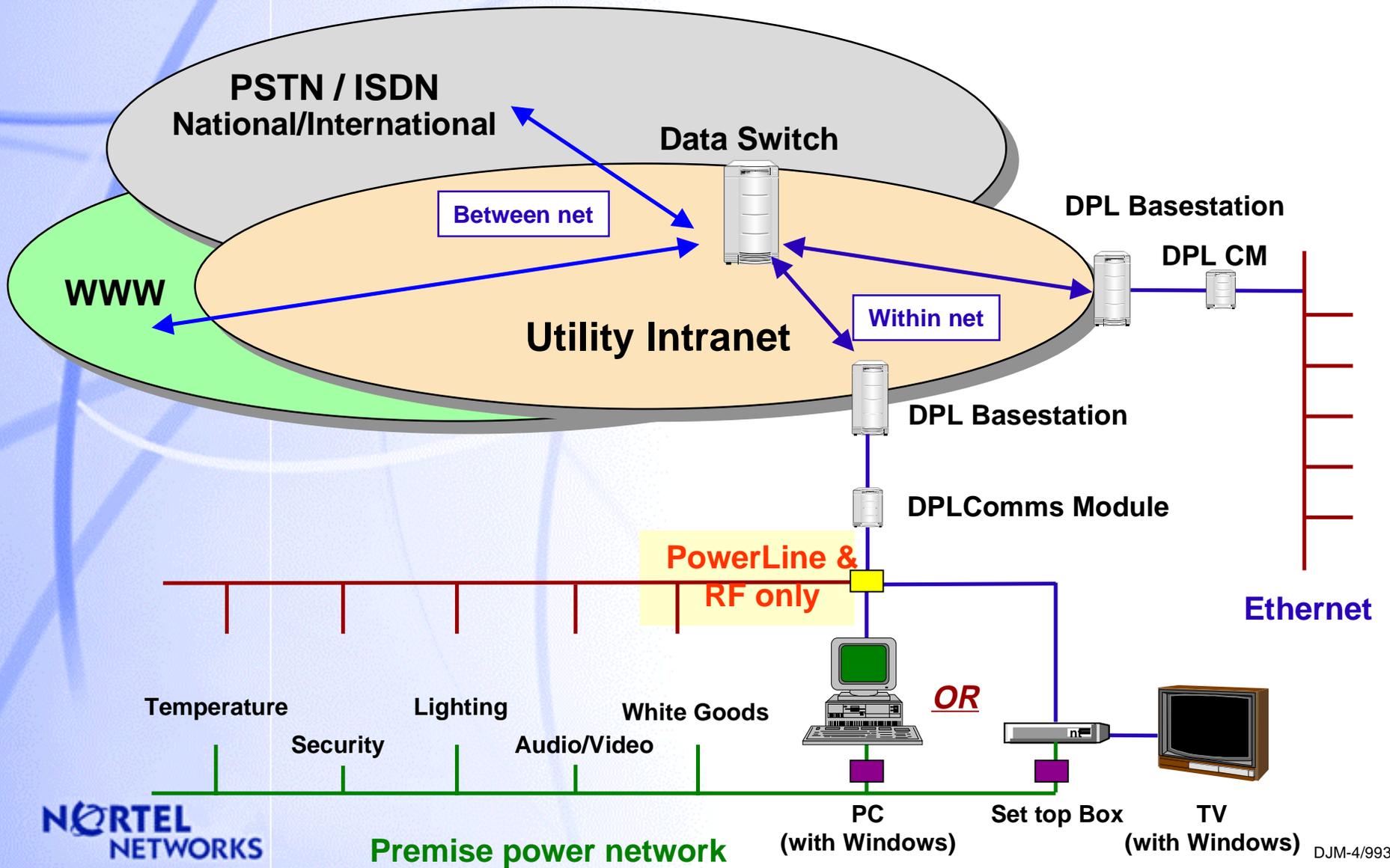
Web TV - Inter/Intranet Services



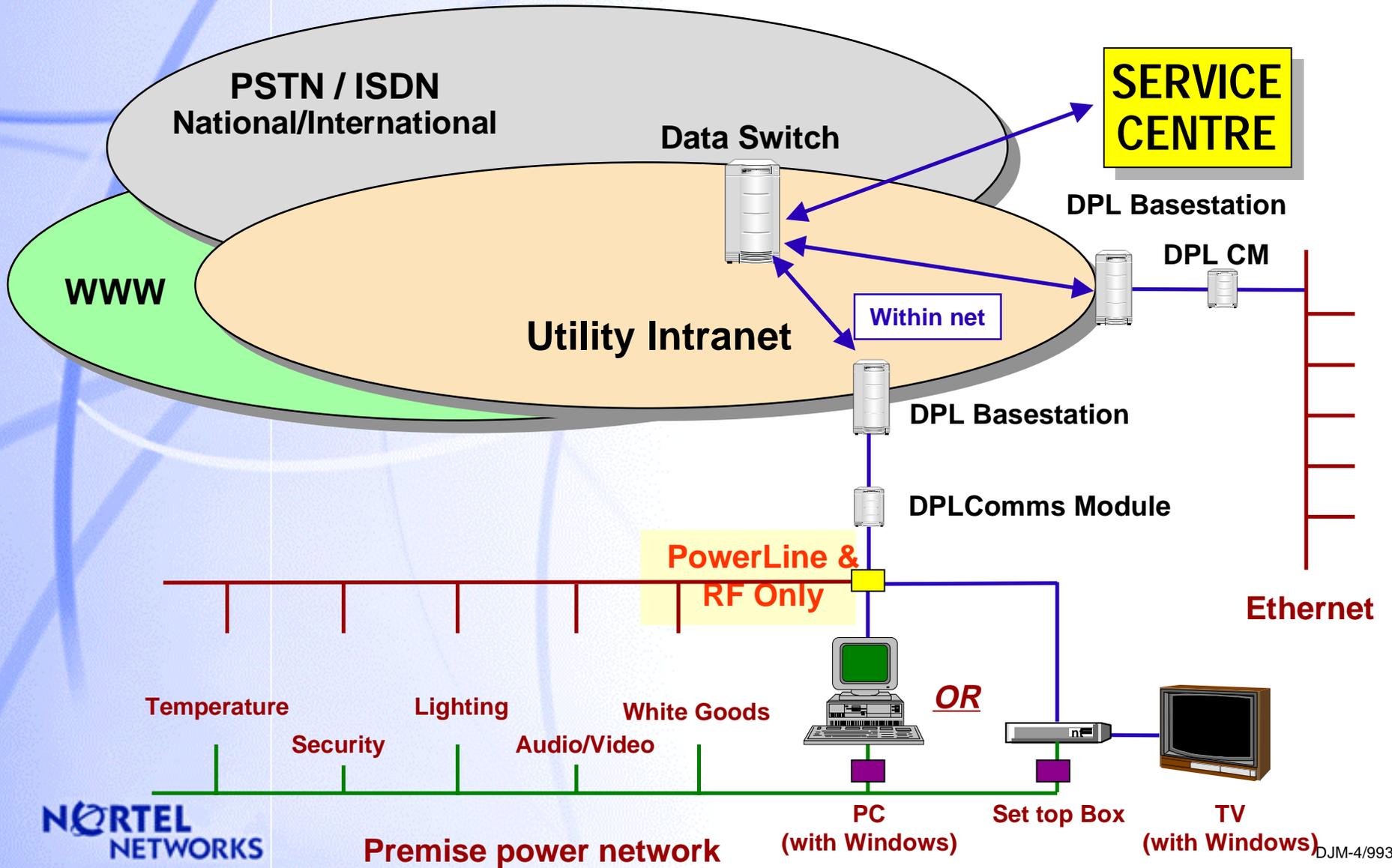
Voice / Conference IP



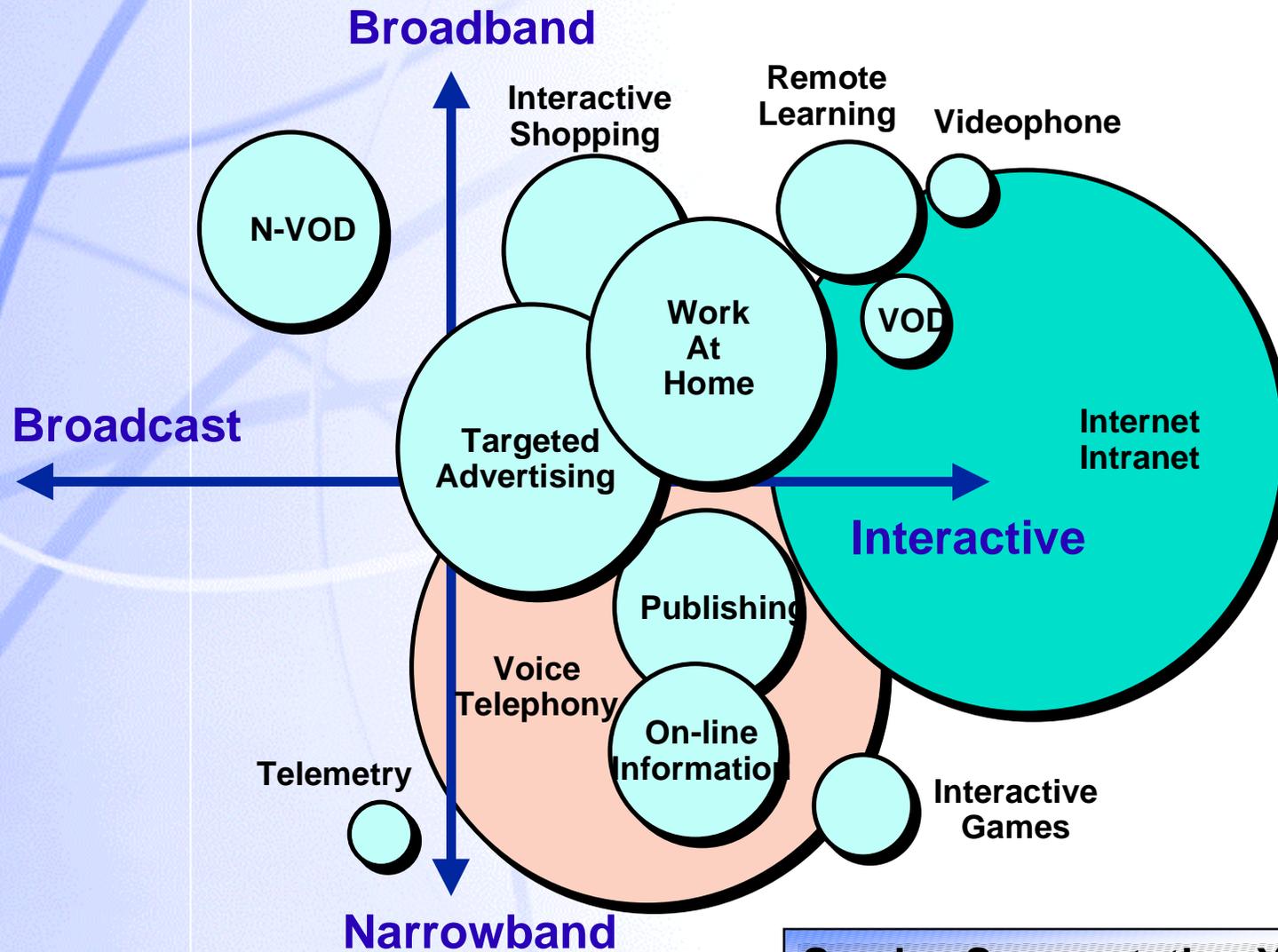
Premise Control / Monitoring



Delivery / Control / Diagnostics



Which are the Winning Services ?



Service Segmentation Year 2001

PowerLine Doesn't Care...

- Mass coverage by powerlines allows flexibility for consumers
- Mass coverage by powerlines allows de-risked investment by industry players
- Mass coverage by powerlines makes it important for the government to encourage success



...It's MegaBits for the Masses!