IPv6 – New applications and Opportunities

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Agenda

• About IPv6
• IPv6: Features and Capabilities
• Areas Impacted by IPv6
• IPv6: Internet of Things
• Where is the Business case
• IPv6 Across Verticals
• Applications relevant for Government Departments
• IPv6 for Citizen Services
• IPv6 Deployment Models
• Pilot Projects
Most enterprises will be on IPv6 by 2013

IT professionals overwhelmingly say they want their companies to be leaders not laggards in IPv6 adoption, Network World survey finds.
What is IPv6?

- Internet Protocol (IP) is the network protocol that drives all content on the Internet.
- IPv6 is version 6 of the Internet Protocol (IP).
- The current version (IPv4) was designed in the 1970s and standardized in 1981.
- IPv4 address space will eventually “run out”. This has already occurred at a global level...
- IPv6 also solves many problems in IPv4 such as security, auto-configuration, and extensibility.
IPv6 – Features and capabilities

✓ Features are of great interest to the Enterprise - Security, mobility, auto-configuration, quality of service, and multicasting
✓ All of these and have been implemented to varying degrees with IPv4 with very limited success
✓ IPv6 offers significant improvements over IPv4 in all above features

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**128-bit Addressing**
- Simplified hierarchal unit addressing allows for more efficient routing
- Supports proliferation of IP-addressed applications/devices such as sensor networks

**Simplified Header Format with QoS**
- Fixed 40-byte header for faster routing/switching
- Guaranteed QoS for various audio/video applications
- Separate Extension Headers for optional features

**Security (Improved from IPv4)**
- Mandatory support for end-to-end (E2E) security, authentication, and non-repudiation simplifies integration of E2E security in applications

**Multicast (Improved from IPv4)**
- Conserves bandwidth through efficient auto-configuration, service discovery, and information dissemination
- Used to form communities of interest (COIs) and geo-spatial multicast groups for efficient and rapid data dissemination

**Auto-Configuration, Auto-Reconfiguration**
- Enhanced plug-n-play reduces administrative workload and O&M Costs
- Quicker responses to crisis situations and ad-hoc organizations

**Network Mobility**
- Tactical on-the-move operations and rapid reorganization
IPv6: Make Possible Internet of Things

More Devices than people

- Smart phones
- Smart Tablets
- Traditional Internet desktops
- Data-enabled mobile phones
- Consumer appliances
- Embedded systems
- Sensors
- RFID

(Increased usage of IP addresses)
How do you promote IPv6?
Various IPv6 deployment models

- Solution led transition
- Forced transition
- Smooth transition
Smooth Transition

– To enable IPv6 at system renovation time, at time of new procurements

– No extra cost needed, Transition as part of life cycle

– Will take 5-7 years to transit to IPv6 gradually

– Enterprise networks with enough time and planning do it
Forced transition

• Government of India mandate:
  – IPv6 adoption by service providers by December, 2011
  – IPv6 adoption by government agencies – Central, State and PSU’s by March 2012
Solution led transition

• System is introduced as a solution which solves a problem users have, regardless of the version of IP

• Here, IPv6 is chosen because IPv6 implementation has many advantages over IPv4.
  – Cheap
  – Easy
  – Fast
  – Extensible and flexible

• Deploy IPv6 through useful applications

• Demonstration through Pilot Projects
Business Case for IPv6
IPv6 Applications – across verticals

**Communication**
- Service providers
- Data centers
- ASP/Web Host

**Energy**
- Smart Grid
- Smart Meters
- Intelligent Buildings

**Transportation**
- Intelligent transportation
- Smart vehicles

**Media**
- IPTV
- Mobile TV

**Healthcare**
- Emergency rural healthcare
- Smart healthcare management systems

**Defense**
- Network centric warfare
- Intelligent warfare systems

**Regulatory Agencies**
- Domain Registrars
- Internet Exchange

**Banking and finance**
- Payment gateways for e-commerce
- Internet banking and e-broking services

IPv6 across verticals
Some Applications Relevant for Government Departments for taking up Pilot Projects

- Centralized Building Management System
- Intelligent Traffic Management System
- Rural Emergency Healthcare System
- Telemedicine (Linking Urban and Rural Hospitals)
- Distance Education
- Power Generation and Distribution
- Logistics and Supply Chain
- Disaster Management
Centralized Building Management System
Using IPv6 Sensors

Implementing a Total Building Management System using IPv6
Intelligent Traffic Management System & Town Security
The term *Intelligent Traffic Management Systems* (ITMS) refers to information and communication technology (applied to **transport infrastructure** and **vehicles**) that improve transport outcomes such as transport safety, transport productivity, travel reliability, informed travel choices, social equity, environmental performance and network operation resilience.
The **Intelligent Traffic Management Systems** (ITMS) infrastructure can also be used for town security because of use of IP cameras at crucial points. This will also help the law enforcement agencies.

Implementing a security town service system by simultaneous control functions of multiple connections and automatic setting functions of IPv6.
Rural Emergency Health Care
**Rural Emergency Healthcare – Current Process**

**Caller in distress**

- Dial 108

**Public Switching Telephone Network (PSTN)**

**Dispatch Officers (DO)**

- Central Co-ordination Contact Center

**Doctor at Contact Center and Nurse in Ambulance coordinate over phone about patient care**

**Ambulances located at strategic places in districts**

**Ambulances nearest to caller located and guided to destination**

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**Deficiencies in Today’s – Rural Emergency Healthcare scenario (Communication only by Phone)**

- Vital sign information sent on phone - Blood pressure, ECG, Temperature .. Etc.
- Doctor lacks the ability to see the patient’s visual condition
- Doctor provides Offline Healthcare on phone
- Ambulances manually called and guided over phone to destination
IPv6 simplifies and enhances Rural Emergency Healthcare

Caller in distress
Dial 108

IPv6 Backbone

Dispatch Officers (DO)
Central Co-ordination Contact Center

Doctor

Bio-sensors help collect Vital sign info which is transmitted in real-time helping doctor provide effective healthcare

GPS helps Locate Ambulance, guides Ambulance driver To destination

3G
Wi-Max

Ambulances located at strategic places in districts

IPv6 Technologies – Rural Emergency Healthcare

• Bio-Sensors
• IPv6 based Real-time Vital signs data transfer

• Seamless Video-Conference
• Automatic Vehicular Location System

✓ Real Time Patient Vital sign information collected by Bio Sensors– Blood pressure, ECG, Temperature .. Etc,

✓ Patient’s condition is seen in real time Video by Doctor - More effective diagnosis and advice

✓ D.O. locates nearest Ambulance - using GPS Driver reaches destination faster via GPS
IPV6 Network of Urban and Rural Hospitals
Hospital Network – Linking Urban & Rural Hospitals using IPv6

IPv6 Network

PHC

IPv6 Network

URBAN HOSPITAL

Rural Health Centre

IPv6 Network

PHC

PHC
Distance Education
Distance Education

- Universalization of Education
- Extending Quality Education to Remote and Rural Areas
- Partially mitigate non availability of good teachers in sufficient numbers

Using Multicast Feature of IPv6
Power Generation and Distribution
Indian Electricity Scenario

<table>
<thead>
<tr>
<th>Power Supply Position (MW)</th>
<th>Demand</th>
<th>Supplied</th>
<th>Shortage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-06</td>
<td>93255</td>
<td>81792</td>
<td>12.3%</td>
</tr>
<tr>
<td>2006-07</td>
<td>100715</td>
<td>86818</td>
<td>13.8%</td>
</tr>
<tr>
<td>2007-08</td>
<td>108866</td>
<td>90793</td>
<td>16.6%</td>
</tr>
<tr>
<td>2008-09</td>
<td>109809</td>
<td>96685</td>
<td>12%</td>
</tr>
</tbody>
</table>

AT&C (Aggregate Technical & Commercial Losses) ~ 33%

Objectives - APDRP (Accelerated Power Development and Reform Programme of the GoI – Funded through Power Finance Corporation - PFC)

✓ Sustained Loss Reduction
✓ Reliable and Automated systems for collection of accurate Base Line Data
✓ Adopting IT for energy accounting
Today’s Scenario

✓ Electricity grid is “DUMB"
✓ Workers have to walk from house to house to read the electricity meter
✓ Utilities have no clue of power outage until customers call to complain.

Tomorrow’s Scenario?

The electricity grid is “SMART” enough for –

✓ Remote collection of data – fully sensor based network
✓ Automatic load balancing, Distribution Side Management (DSM) and transfer of power from one region to another
✓ Automatic detection of outages
✓ Flexible metering, Time of Day Metering

What will make it possible? IPv6
The Smart Grid is a large Electricity Network that supports the reliable delivery of electrical power using IT infrastructure in the ecosystem.

- Continuous energy measurements for maintenance and billing purposes
- Communication between cooperating processes such as generators and phase measurement units
- Operational command/control – turning circuits on and off, demand response, many other purposes
Using IPv6 for Smart grid Services

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td><strong>Advanced Metering</strong></td>
<td>Automatic meter Reading using sensors</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
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<tr>
<td><strong>Business Analysis</strong></td>
<td>Analyze usage data to make decisions</td>
</tr>
<tr>
<td><strong>Energy Management</strong></td>
<td>Grid monitoring and management</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Demand Side</strong></td>
<td>Remote management of energy demand, Load balancing</td>
</tr>
<tr>
<td><strong>management</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Optimize performance of Transmission and Distribution assets</td>
</tr>
<tr>
<td><strong>automation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Remote equipment</strong></td>
<td>Ease of fault detection, maintenance</td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Telecommunications</strong></td>
<td>Can be provided as a service using the power line infrastructure</td>
</tr>
<tr>
<td>****</td>
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</tbody>
</table>
Logistics and Supply Chain
(Example of Railways)
IPv6 in Railways
How can Railways benefit from IPv6 deployment?

Railways handles **India’s largest supply chain** consisting of wagons, bogies, engines, processing centers, point of sale terminals, millions of parcel objects each day.

- Service Automation
- Connectivity
- Addressability
- Scalable Internet Platform
- IPv6
DISASTER MANAGEMENT
IPv6 For Disaster Management

When an emergency / disaster happens then?

- Little or no warning
- No time to prepare

What IPv6 can do?
Enable responders to set up highly secure mobile or video conferencing in an adhoc manner, giving employees from different agencies and organizations the ability to communicate.

(Compare that to a hastily formed group trying to coordinate emergency response plans while using different networks)

With IPv6 technology, disparate networks can be joined as one. The various agencies on the scene can collaborate and coordinate a response in a better way.
IPv6 for Citizen Services
IT Infrastructure in States

- State Wide Area Network (SWAN)
- State Wide Data Center (SDC)
- Common services Center (CSC)
- E-Governance services
- Citizen services

E-governance/Citizen services Applications

- UID services
- Ration card services
- Passport services
- Income tax services
- Electoral services
- Police services
- Education services
- Healthcare services
- Energy monitoring
- And so forth ....
Pilot projects
Need for Pilot projects

IPv6 Adoption Challenges

- Large Investments in Current IPv4 Infrastructure
- Uncertainty of Market Demand
- Lack of IPv6 Skills
- Lack of IPv6 ready products and solutions
- Lack of Government incentives

Need for IPv6 solutions that:
- Build confidence in IPv6 as a technology – Showcase IPv6 ready products and solutions
- Showcase RoI on IPv6 investments
- Showcase application of IPv6 in e-governance/citizen services – Create market demand
- Showcase that IPv6 applications can impact/enhance the lives of our citizens – Create market demand
- Solutions that can be adopted and replicated across cities/districts/states
IPv6 Pilot Project - Goals

- **Technology demonstration** – Build confidence in IPv6 as a technology
- **Showcase solutions** – which result in RoI
- **Social benefits** – Impacting common man
- **Innovation** – New ideas and solutions, Entrepreneurship
A few IPv6 pilot projects suggested

<table>
<thead>
<tr>
<th>Sector</th>
<th>Pilot project</th>
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<tbody>
<tr>
<td>Healthcare</td>
<td>IPv6 based Healthcare/tele-medicine</td>
</tr>
<tr>
<td></td>
<td>• Electronic Health records linked to Adhaar and stored centrally</td>
</tr>
<tr>
<td></td>
<td>• Providing health based benefits to beneficiaries using IPv6 enabled devices</td>
</tr>
<tr>
<td></td>
<td>and authentication based on Adhaar</td>
</tr>
<tr>
<td>Education</td>
<td>IPv6 based e-learning system</td>
</tr>
<tr>
<td></td>
<td>• Learning system pervading across multiple technologies, mobile, handheld</td>
</tr>
<tr>
<td></td>
<td>device, TV and other means</td>
</tr>
<tr>
<td></td>
<td>• Adhaar based system for individual specific learning courses and methods</td>
</tr>
<tr>
<td>Citizen services</td>
<td>Delivery of Citizen Services over IPv6 enabled SDG (issuance of Income</td>
</tr>
<tr>
<td></td>
<td>Certificate, Child School performance monitoring System)</td>
</tr>
<tr>
<td>Agriculture</td>
<td>IPv6 enablement of Wireless Sensors for Agriculture use</td>
</tr>
<tr>
<td></td>
<td>(Example in a greenhouse to monitor temperature and moisture and turn on</td>
</tr>
<tr>
<td></td>
<td>relevant devices to control these parameters)</td>
</tr>
<tr>
<td>Smart-Grid</td>
<td>IPv6 based electricity Smart-Grid, to monitor, measure and manage electricity</td>
</tr>
<tr>
<td></td>
<td>networks</td>
</tr>
</tbody>
</table>
IPv6 adoption planning
- IPv6 Readiness assessment
- Deployment plan
- Support plan

IPv6 Architect and Design

IPv6 deployment and implementation

Test and validate – IPv6 implementation

IPv6 trials

Go Live – IPv6 services

IPv6 service support

Review IPv4 plans

Typical – IPv6 Pilot project Timelines

Planning – Phase (1-2 months)

Deployment – Phase (10 – 16 months)

Support – Phase (Continuous)
Situation
- Energy saving and lowering the greenhouse gas emission is now a major agenda across the world including India.
- Under Kyoto protocol every business establishment, every company was obliged to take up energy saving initiatives.
- IPv6 based energy efficiency management systems being developed globally to progress energy efficiency management systems.

Scope
- Measurement of environment parameters like presence of people, temperature, humidity, cooling and so forth without facilities management experts
- Collection of environmental parameters across multiple offices, thereby help plan the total energy saving across an organization
- Open-architecture for integration of Multi-vender products and solutions
- Use of TCP/IP, IPv6, Web, etc

Leverage Technology beyond “National IPv6 Deployment Roadmap”

Success Metrics
- Energy efficiency of 11-30%
- Significantly reduced energy bills
- Availability of carbon credit details for trading use

Benefits
- Energy efficiency of 20-30%
- Integrated Energy data management and reporting
- Carbon accounting and CRC reporting tool – Carbon credit details
- Reduced energy bills and RoI

Expected Outcome
- Patient Identification, authentication and Electronic health record integration to Aadhaar
- Provide Telemedicine as an alternate referral feature in maternity and infant health
- Demonstrate measurable technology and health based benefits adopting IPv6 Deployment Roadmap
### Situation
- Access to health in Himachal Pradesh is a challenge due to improper roads, low hills and high mountains.
- 87% Population in Himachal Pradesh lives in Rural.
- One fifth of households are headed by women.
- Perinatal mortality 30/1000, over two and half times higher in rural areas.
- Infant Mortality 36/1000, 1 in 28 die within first year, 1 in 24 die before age Five.

### Scope
- Implement and demonstrate a framework by connecting Indira Gandhi Medical College to three Primary Health Centres.
- To adopt “National IPv6 Deployment Roadmap” and demonstrate Aadhar integrated IPv6 based Telemedicine in Maternity and Infant Healthcare.
- Develop & Publish white paper to replicate the model for all states.

### Leverage Technology beyond “National IPv6 Deployment Roadmap”

### Success Metrics
- Improvement in the patient care (Specific metrics to reduce maternal and infant mortality).
- Increased skills of the hospital staff to use ICT, IPv6 enabled devices as well as medical equipments.
- Increased skills of the doctors in the Rural hospital due to interactions with the Specialists.

### Benefits
- 80% of maternal deaths could be avoided by access to essential maternity & infant health services at rural.
- Framework to enable single IPv6 based Telemedicine infrastructure for multiple rural health services.
- Integration Aadhaar UID for rural Healthcare services.

### Expected Outcome
- Patient Identification, authentication and Electronic health record integration to Adhaar.
- Provide Telemedicine as an alternate referral feature in maternity and infant health.
- Demonstrate measurable technology and health based benefits adopting IPv6 Deployment Roadmap.
### Situation
- Cumbersome process for applying for Birth/Death Certificate as CSC’s are not the better option for accessing the e-services.
- Distant offices for applying & Approval of Birth/Death certificates, not in immediate reach of the citizens
- Paper based approach for the Birth/death certificates

### Scope
- A PKI based Birth/Death Certificate issuance systems which is IPV6 enabled.
- Support for request for certificates from any handheld device on which the application is deployed.
- Support for request for the certificate through mobile by citizens by using UID of Guardians applying for the same (Integration with Adhaar)
- Support for approval of the certificate by registrar (identified by UID) using handheld device

### Success Metrics
- Significantly reduced paper based transactions
- Reduced security related expenditure because of usage of IPv6 security features
- Reduced turn-around time, because of usage of mobile technologies

### Benefits
- Paperless - digital IPv6 based birth and death certificates
- IPv6 based mobile and security technologies used
- Reduced costs due to digital automation

### Expected Outcome
- A complete IPV6 enabled Application for issuance of Birth/Death Certificates. The sub-systems which are identified to be the outcome of this project are
  - Mobile Environment setup
  - Development of M-Forms with control logic (for request of certificates) for citizens and (for request approval) for Registrars
Situation

- Data Center has high energy costs
- Lack of intelligent cooling and energy management systems
- Lack of control over cooling and energy management of assets

Scope

- Energy efficient data centre making use of the IPv6 technologies
- Measurement of power consumption, temperature, humidity, air pressure and so forth using IPv6 enabled sensors
- Provide intelligent analytics and automated process for energy management

Success Metrics

- Improvement in energy usage of the Data Center
- Optimized Data Center computing efficiency
- Metrics and visibility of Data Center asset usage

Benefits

- 20-30% - Energy savings
- Efficient Data Center asset management system
- Increased ROI on the IT assets invested and managed

Expected Outcome

- Energy efficient Data Center – 20-30% energy savings
- IPv6 technology demonstration - for energy monitoring and management
Government initiative for promoting Applications using IPV6

• Promote Pilot Projects for Public
• Facilitate software development companies to develop IP Neutral applications, incorporate IPV6 capabilities in new software.
• Promote Research and Development into new applications that leverage IPV6 Functionality.
http://www.tec.gov.in