# Fujitsu views on D2D research and standardisation challenges

Mythri Hunukumbure
Fujitsu Labs of Europe Ltd.

# Fujitsu's take on D2D

**FUJITSU**

- Fujitsu considers D2D as a key development in LTE Release 12 standardisation.

  - Actively contributes to standard development.

  - Sees high potential in proximity based services and for applications in disaster and emergency situations.

- Fujitsu also views the challenge of 'retro-fitting' D2D solutions (BS mimicking, relaying) to existing RATs (3G, 2G), to cope with D&E situations.

  - LTE will only offer urban, hot-spot coverage for many years in developing countries.

  - Devices with enhanced (BS like) capabilities can provide essential connectivity in legacy systems under D&E.

# D&E prediction, communication

**FUJITSU**



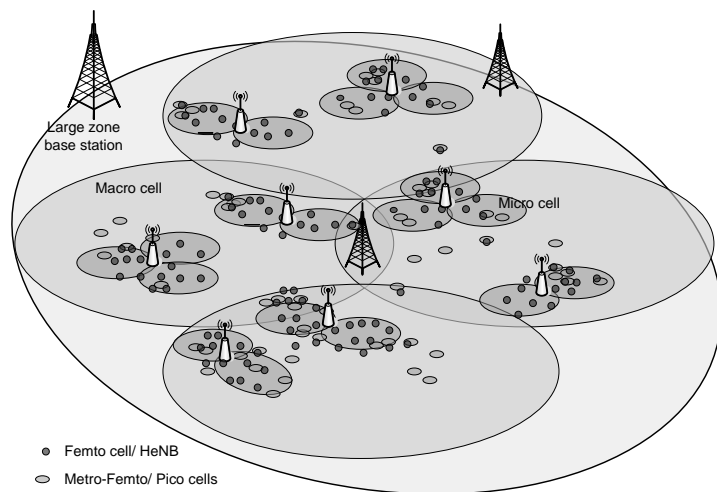- Fujitsu - extensive expertise in super-computing:

  - In 2011-12, Fujitsu created the fastest super-computer.

  - Supports applications to use super computing power for weather/ climate predictions.

- As an ICT giant, Fujitsu develops technologies to predict disaster/ emergency events and enable communications in pre-warnings, post relief efforts.

  - At FLE, we are focussed on enhancing these dual capabilities – predictions and effective communications.

# D2D for post-disaster relief

**FUJITSU**

- HetNet's can loose 1 or 2 layers due to D&E, but higher layers can provide DL coverage.

- In UL, the UEs can be power limited. Saving power is critical for UEs in need of assistance.



Large zone base station
Macro cell
Micro cell
Femto cell/ HeNB
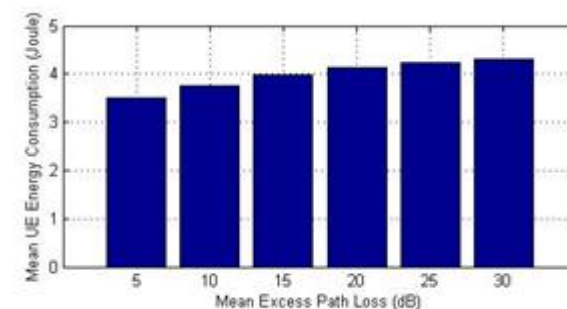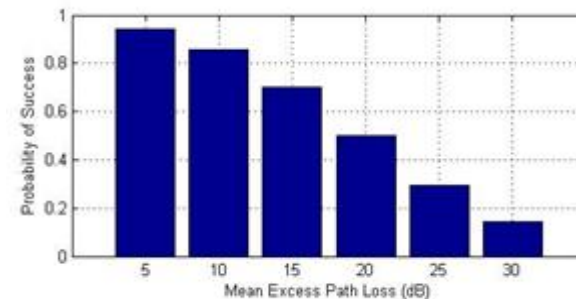Metro-Femto/ Pico cells

- In industrial disasters like building collapses, the victims' UEs get covered with rubble. Makes it harder to communicate to eNBs.

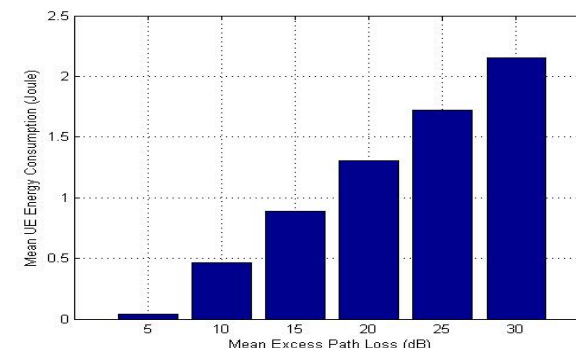- D2D and then D2I sessions, guided by eNB, enable critical UE location information to be obtained.



Building collapse, Bangladesh, 2013

# D2D energy saving potential

**FUJITSU**

- ■ In a 3G simulation study:

  - ■ The required energy for default text messaging and D2D based (mimic BS) messaging compared.

  - ■ Additional excess path loss (EPL), [5:5:30]dB considered.

- ■ Comparable results in lower EPL.

  - ■ For higher EPL, success rate drops.

  - ■ In 5, 10 dB EPL, energy used by D2D messaging is 90 times and 8 times lower, including CSI signalling.

  - ■ Future work - delay analysis.



**Default text messaging**
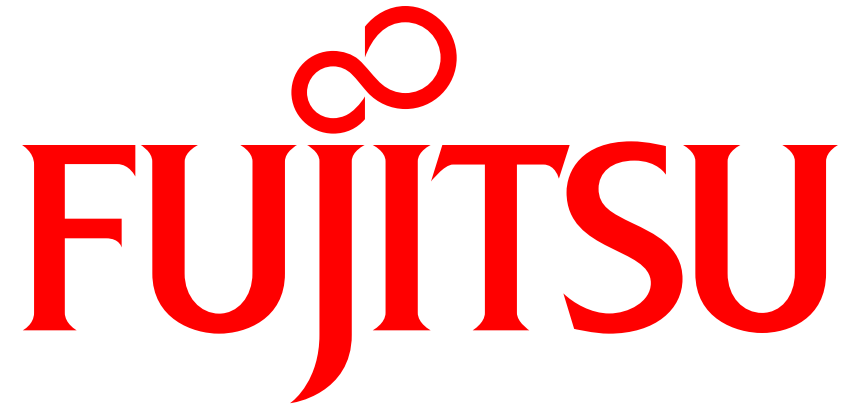


**D2D based messaging**

# D2D for disaster warning

- **Prediction capabilities improving to capture even localized disasters.**
  - It is now possible to predict flash floods, landslides etc.

- **Warnings need to be issued only to a targeted segment of the population.**
  - With general warnings, people loose confidence in them.
  - Sometimes people have to weigh-up against the safety of their property, livestock.

- **In many rural areas, targeted localization is difficult.**
  - The cheaper feature phones do not possess GPS locating
  - In areas covered by a single eNB, cannot use trilateration.

# How to address challenges

**FUJITSU**

- Fujitsu will continue to support LTE standardisation tasks for D2D.

- Develop the provision of complete disaster prediction and communications solutions with D2D.
  - Communications solutions to fit in with existing 3G or even 2G technology.
  - Minimal network changes and mostly utilize existing UEs.

- FLE very keen to collaborate with industrial and academic partners to further develop, validate and test some of the 'retro- fitting' solutions.
  - We see significant social and commercial value here.