LS telcom Summit 2014

Can public safety share wireless infrastructure with utilities & the transportation sector?

Robert Horvitz
Email: horvitz@volny.cz

Public safety in Europe mainly uses TETRA

Exceptions:

- Cyprus (pre-TETRA analog)
- Czech Republic (patchwork of TETRAPOL & TETRA)
- France (TETRAPOL with some analog VHF for EMS & fire)
- Italy (build-out halted due to economic crisis)
- Latvia (ASTRO 25 network)
- Malta (pre-TETRA analog)
- Romania (combination of TETRA, TETRAPOL & WiMAX)
- Slovakia (TETRAPOL)
- Slovenia (in transition from APCO 25 to TETRA)
- Spain (regional TETRA & national TETRAPOL)
- Switzerland (TETRAPOL)

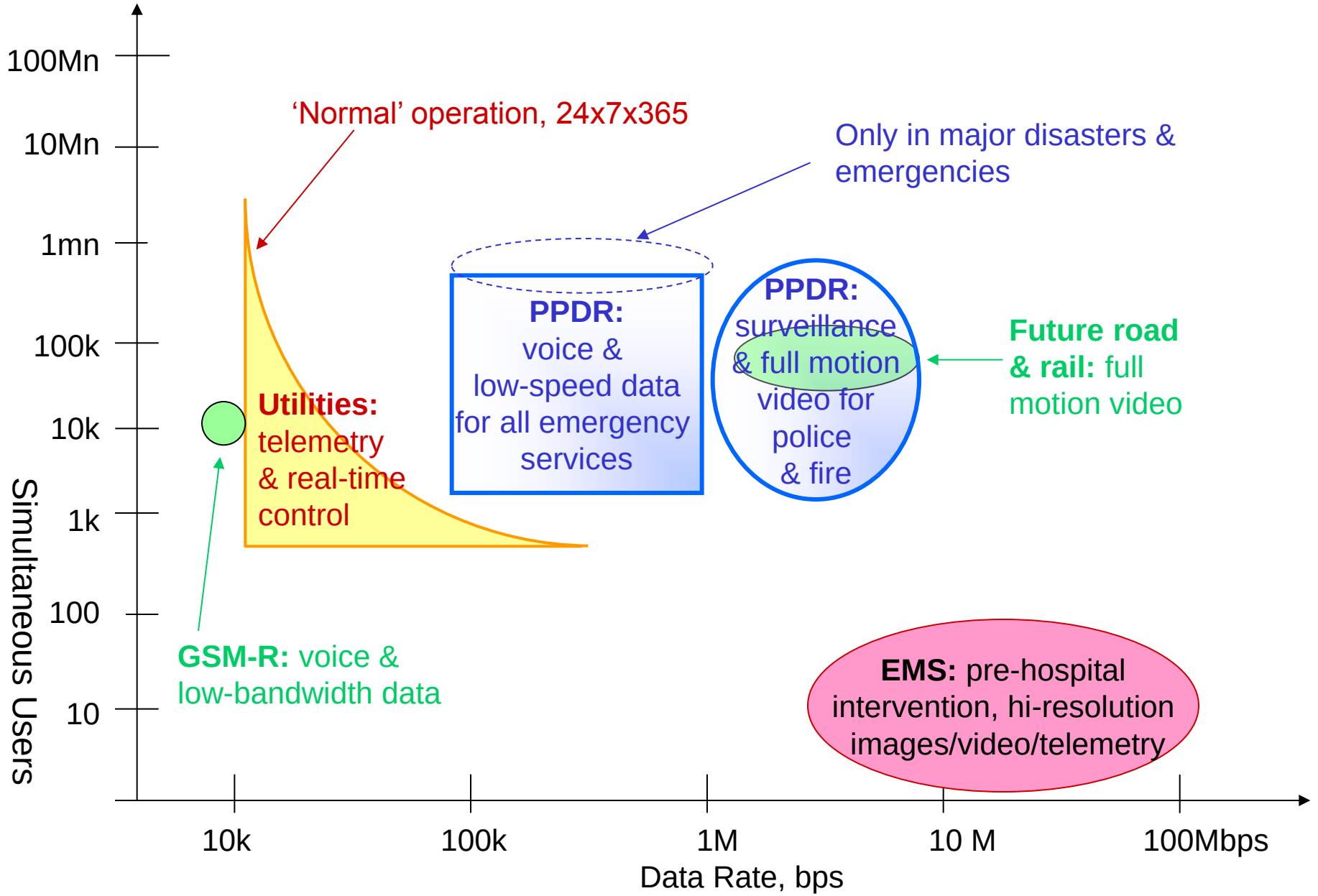
Some use of TETRA by utilities & transport sector; further uptake possible

- Croatia's HEP (electricity/gas/heat)
- Czech Republic (public transport)
- Denmark (railways, Copenhagen transport, energy)
- Finland (Helsinki energy)
- France (national railway)
- Germany (airports, public transport)
- Luxembourg (electricity & gas)
- Norway (hydroelectric, pipelines, offshore wind)

But…

- TETRA's cost is an obstacle
- Utilities & transport have slow equipment replacement cycles
- GSM-R has strong support among railways
- GPRS has "good enough" cost/bandwidth ratio for smart metering, traffic management
  - License exempt UHF (*e.g.* 863-876 MHz) also good enough for routine utility & transport needs
- Even within PPDR, many fire brigades reluctant to give up analog VHF
  - Paging & cellular used to rally volunteers
- ***Broadband data & high-resolution/full-motion video are beyond TETRA's capabilities***

Sector Requirements: bandwidth, data speed, simultaneous users



Utility requirements (electricity, water, gas) - 1

- Reliable, resilient, delay-less networks for **critical infrastructure:** high voltage electricity lines, transnational gas pipelines, LNG ports, nuclear power plants (including fuel/waste cycle)
  - Fixed lines preferred for reliability & 5-10ms SCADA response time (radio only for backup)
- Most other utility communications can be considered routine or "business critical" rather than "mission critical"
  - Main needs: fault alarms & a steady trickle of quantitative data on condition of supply/distribution network
  - Broadband not an urgent requirement
  - Cost more important than bandwidth for many applications

Utility requirements (electricity, water, gas) - 2

- Mobile voice needed for dispatch & communication with repair & maintenance crews
- Video (slow-scan & full-motion) needed for access control
- All utilities need resilient radio services to co-ordinate recovery from outages & disasters
  - if dependent on cellular, power loss may impede recovery
- Could use an integrated PPDR platform if it improves inter-working with Emergency Services without mutual blocking
- **The major considerations for utilities are for communications which are highly reliable yet low cost**

Differences among utilities - 1

Electricity

- Society/economy increasingly rely on constant flow of electricity; short-term gas & water interruptions are tolerable
- Electric power outages have cascade effects on other vital services (*e.g.* mobile telephony, broadcasting & Internet) so response to disruptions must be fast even if lives not in immediate danger
- Radio increasingly used to support low voltage distribution network (smart meters, home area networks)
- Despite vulnerability, smart electricity grids are likely to develop in license exempt spectrum due to minimal cost + maximum flexibility
- In future, decentralised power generation (dispersed inputs from time-varying renewables like solar & wind) will require constant active voltage management
  - Networks becoming geodesic rather than radial/hierarchical

Differences among utilities - 2

Gas, water & sewage

- Infrastructures mostly buried, so radio's role is limited
- Gas utilities use radio (voice & sensor data) for security & to manage repairs
- Water utilities use short, very low bandwidth data bursts to gather information from vast sensor networks & remote areas, open & close valves, etc.
  - Erratic patterns of flooding & drought in recent years suggest Europe needs to develop much larger, automated water control systems

Transport sector

"Mission critical" = accident/injury prevention

Radio's main value: facilitate routine operation, smooth traffic flow

Many emerging/futuristic concepts. Today's common applications:

- GPS navigation
- Traffic management
- Signal timing/synchronisation
- Railway & mass transit operations
- Fleet tracking
- Number plate recognition
- Pollution sensors
- Public transport passenger info services
- RFID toll collection
- Zone access controls (congestion charges, truck exclusion times, etc.)
- Parking space management
- Radar (short-range for parking & for vehicle speed measurement)
- Variable message signs
- CCTV "trafficams"
- *Soon:* eCall accident alerts

Many different frequency bands allocated already: some exclusive, some shared, most license exempt

Many applications use GPRS, so LTE could support, but developers want cheaper options

Transport sector: GSM-R

- Railways would gladly use this technology for 20-30 more years – but if commercial cellular phases out GSM, that may not be possible
- GSM-R is voice-centric but uses GPRS for rail traffic management:
  - Driverless trains & info services for passengers depend on sensors more than video
  - Not much foreseeable demand for broadband, except to serve passengers
- DRIVER: European Commission's 2011 Transportation white paper, which says by 2050 medium-distance passengers & freight should mainly travel by rail rather than by road
  - Implies increased train density, more reliable train movement authorisation
  - So long as network is reliable, does not have to be dedicated or railway owned/operated.

Differences among PPDR sectors

Police

- Primary need: reliable, secure, authenticated, low-latency voice, with
  - Priority levels, DMO, PTT, all-calls for dynamic user groups
  - Dispatching & control room links for monitoring/support
  - Mobile local hubs & control centres, including for UAV / AGA
  - Tactical channels, ambience monitoring, links to investigative resources
- Primary broadband needs:
  - Video recording & real-time streaming
  - Future: video/sensors/remote control for UAVs & robots; possibly video legal documentation (witness testimony, arraignment, etc.)
- Secondary data needs (could be narrow or wideband)
  - Administrative actions, forms & reports

Differences among PPDR sectors

Fire

- Radio signals *must* penetrate buildings
- Local data links for infrared cameras, motion sensors, remotely controlled robots & scouts, etc.
- Access to building plans, HAZMAT/flammable materials databases
- Handsets must be:
  - Usable with gloves & face masks on
  - Heat & water resistant
  - Reliable DMO (proximity service)
  - Automatically report 3D location & vital signs of fireground personnel
  - Intrinsically safe in explosive atmospheres
- Volunteers important in many EU Member States, especially in rural areas
  - Called to duty by pager, SMS or cellular
  - More medical/rescue calls than fires

Differences among PPDR sectors

Emergency medical

- Rapid dispatch with on-route review of victim's reported condition & medical history
- Value of broadband for onsite medical emergency care increasing rapidly:
  - Imagery for telemedicine & paramedic guidance
  - Onsite vital signs monitoring, sonar scans, remote diagnosis
  - Preparation of hospital for patient intake
  - Phone-patching through control centre
- Need for symmetric data upload/download, low packet latency
- Onsite DMO less important as EMS personnel often within voice range of one another
- Also provide non-emergency patient transport

Differences among PPDR sectors

Rescue/disaster recovery

- Air-ground-air important for urgent transport, flooding, coastal waters, mountain & off-road rescue
- Foreseeable growth in use of surveillance UAVs/drones for search & ad hoc wireless communication coverage
- Voice still dominant but video/data as useful as for other PPDR services
  - Beacon detection capability for sea/avalanche/ski rescue
  - Rescuers consider today's equipment inadequate, future changes likely
- Longer signal range and/or opportunistic connectivity often needed
  - Cellular coverage may be limited in incident/event areas or disrupted by emergency conditions
- "Whatever works": combining multiple links is often the best option
  - Cellular, satellite, PMR, maritime, Wi-Fi, amateur, etc.

Conclusions

- Because various bandwidths & radio propagation characteristics are desirable, many different networks are already used within each sector & subsector
  - Therefore, a single comprehensive solution for all sectors is unlikely to be acceptable
- Video drives the need for broadband, but some sectors don't require it
- Great hopes for LTE because it is still evolving & might become what potential users want
  - But also widespread mistrust of commercial cellular & that business model

LS telcom Summit 2014

Can public safety share wireless infrastructure with utilities & the transportation sector?

Robert Horvitz
Email: horvitz@volny.cz