Open Wireless Points of Presence: Distributed Antenna Networks

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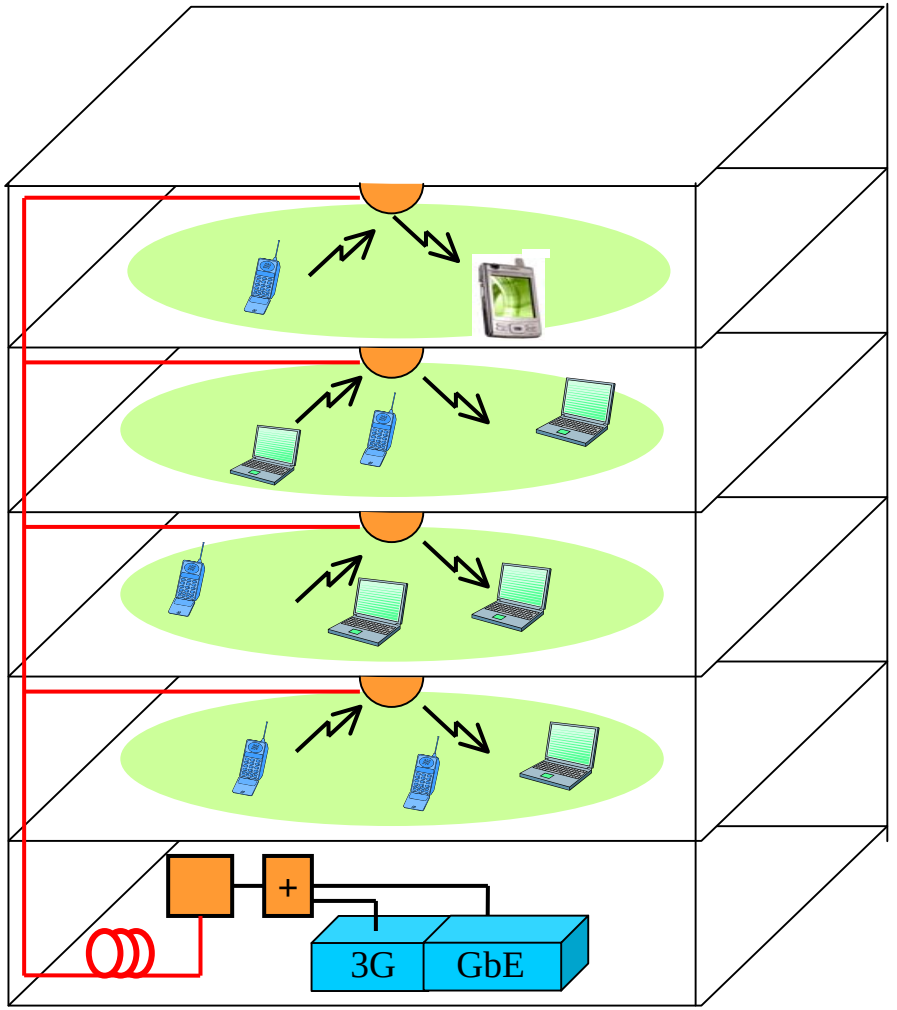
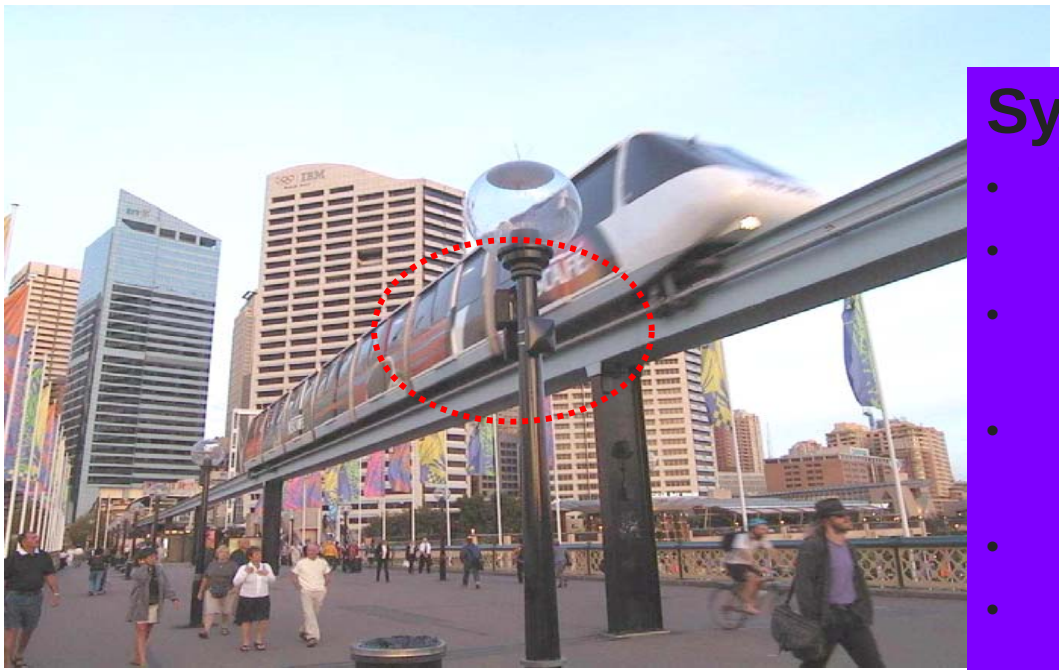
Distributed Antenna Systems - Conventional Rationale

- Unreliable cellular coverage from outdoor cells
- Dedicated indoor capacity
- Fewer RF transceivers needed compared to distributed radios
- Applicable to other radio services – eg. WiFi
- Currently expensive – limiting applications to high value locations such as airports



Radio over Fibre DAS

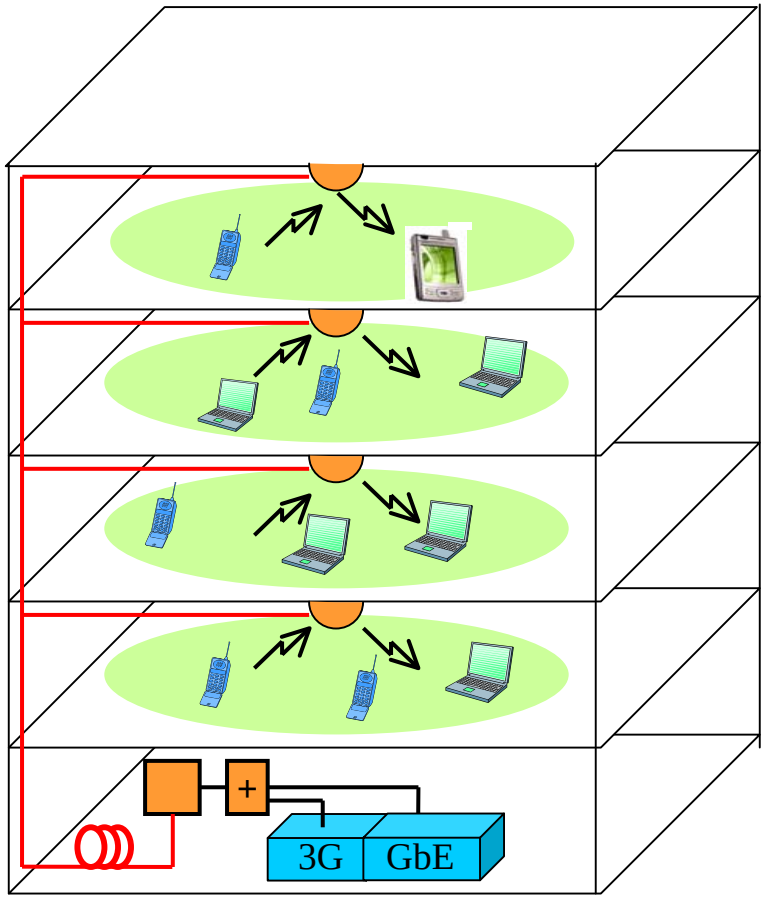
Existing Installation



Sydney Olympic Games

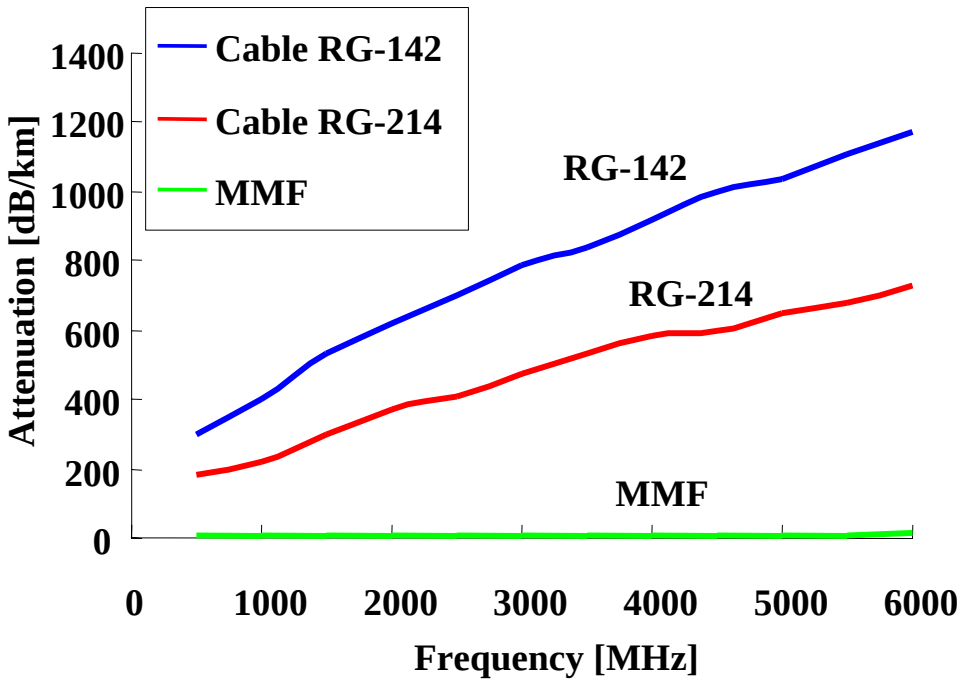
- Tekmar BriteCell™
- In-building and external pico-cell
- Multi-operator system (3 GSM operators)
- Multi-standard radio (900/1800 MHz GSM)
- > 500 Remote Antenna Units
- 500 000 wireless calls on the opening day

Distributed Antenna Systems - What if?



- The system allowed
  - Transmission of services of choice without hardware upgrade
    - *Transparent hardware*
    - *Overlapping antenna coverage*
  - Control of services/operators throughout building from central location
  - Rapid reconfigurability of network
    - *WLAN feels like a wired LAN*
  - Distributed controlled wireless environments

Why radio-over-fibre rather than / as well as over-copper?



Transparency

- Thanks to research in recent years both single mode and multimode optical fibres can transmit RF signals over km distances using directly modulated low cost laser sources.
- The very high bandwidth of optical fibres ensures that radio-over-fibre system is transparent to different RF modulation schemes – *however limits are uncertain*

Easy system planning

- *Link loss is almost independent of the fibre length*
- *Fiber loss <0.5 dB/km for SMF, 0.5~2 dB/km for MMF*
- *Copper loss: RG-214, 11mm diameter*

CII Applications Studies: How does Fibre do?

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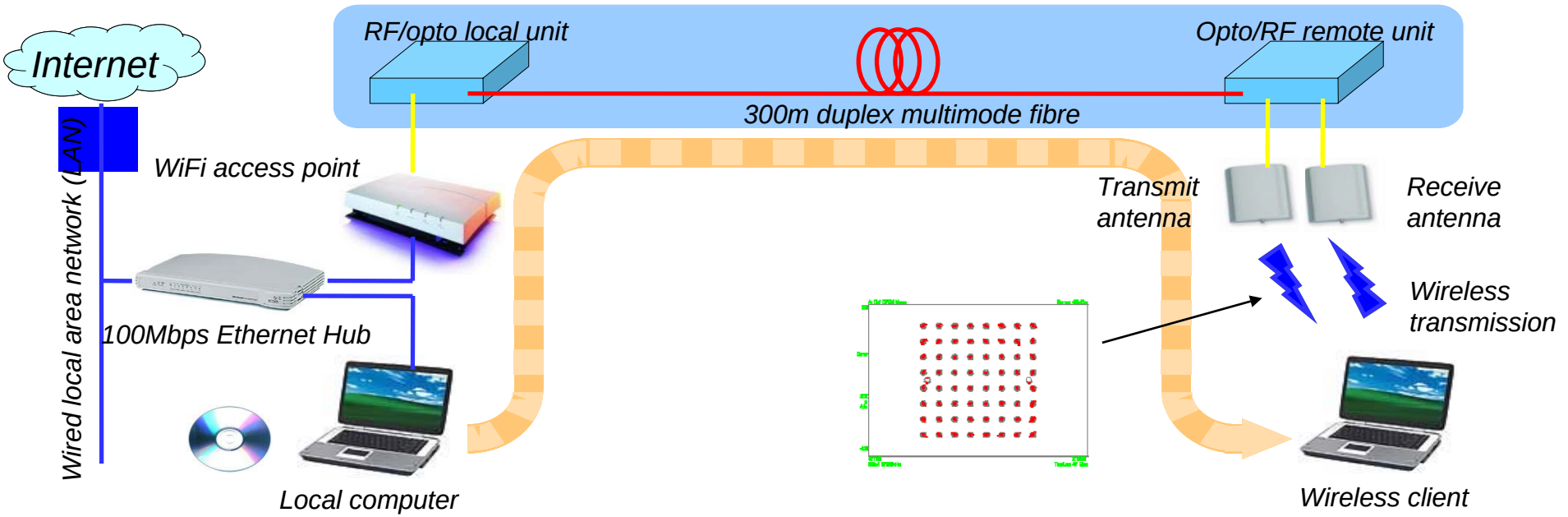
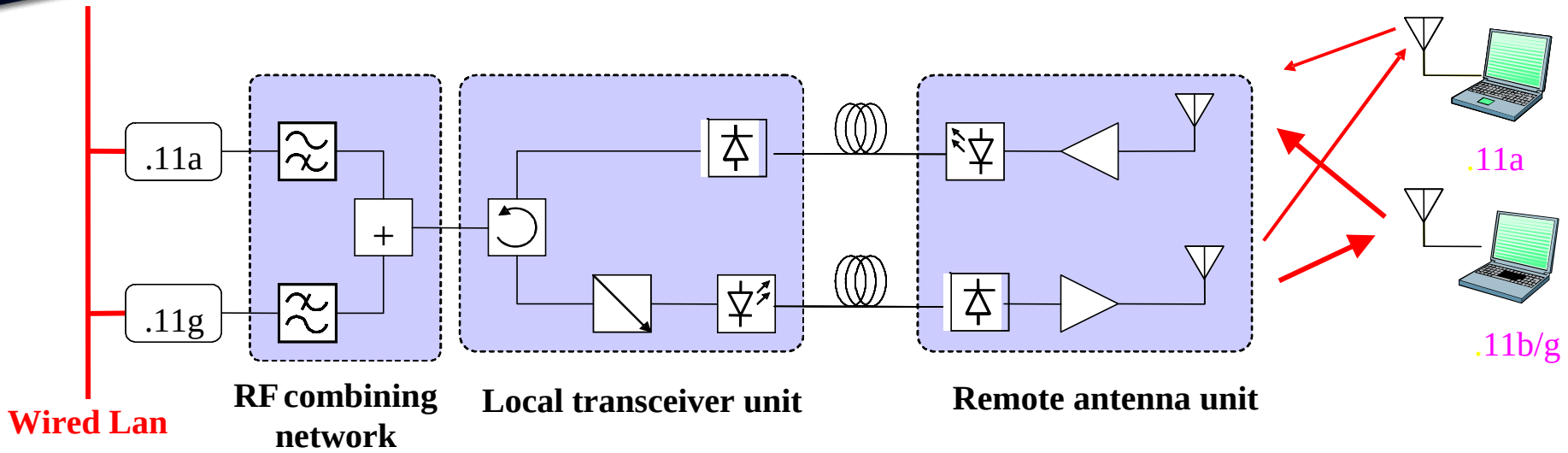
CRN is
exploring the potential impact of **low cost** technologies for RF distribution.

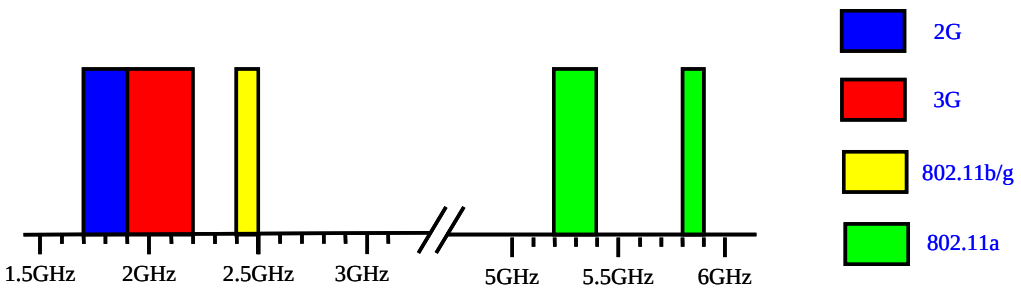


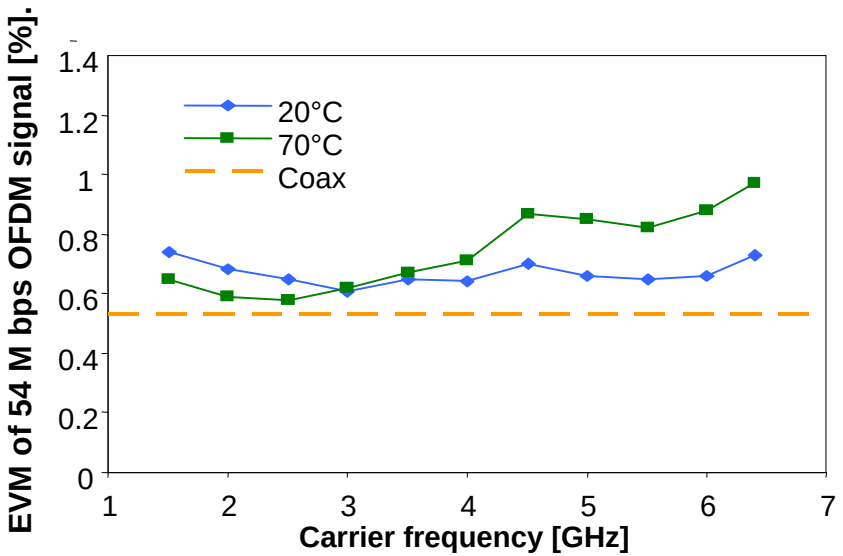
Multi-Service Transmission of IEEE 802.11a/g

Communications Research Network

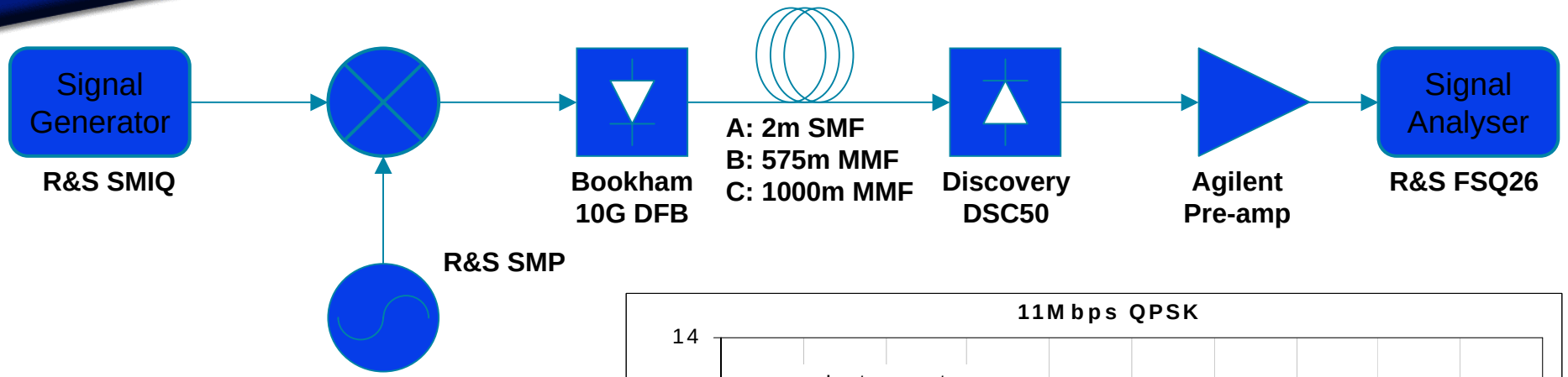
IEEE specification up to 1375m MMF link length



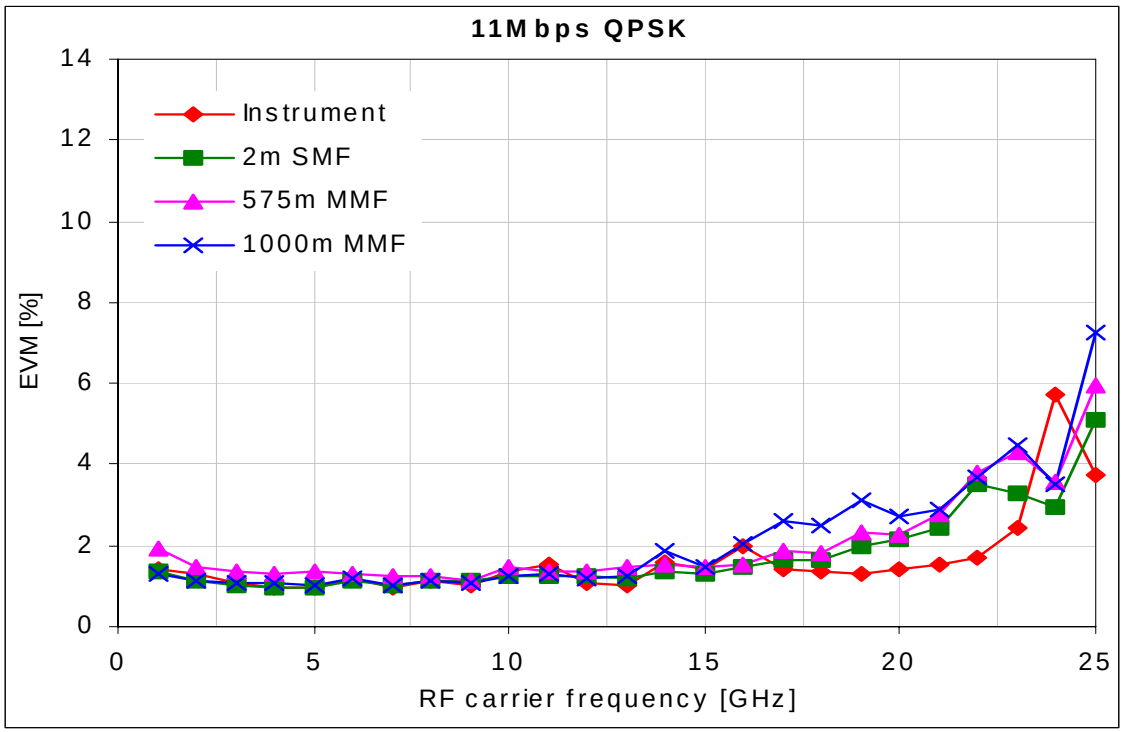




Can RF over Fibre be expected to cover new standards?



- ***Use of uncooled directly modulated Lasers!***
- ***Operation possible for either single- or multi-mode optical fibre!***



Can RF over fibre deliver Medium-range Multi-user wireless networking?

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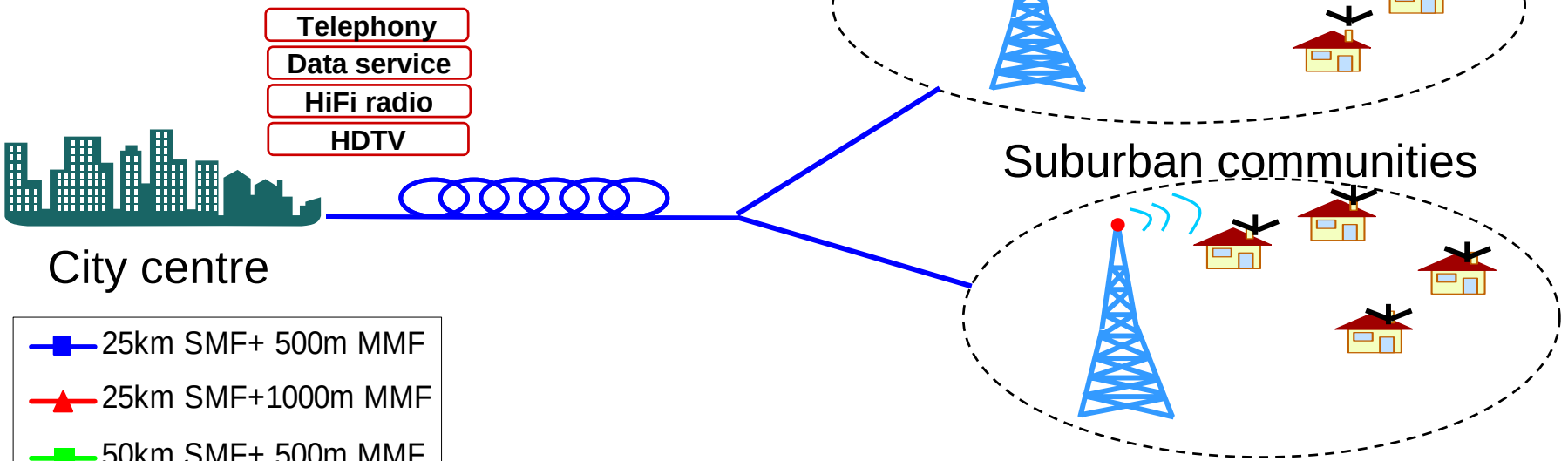

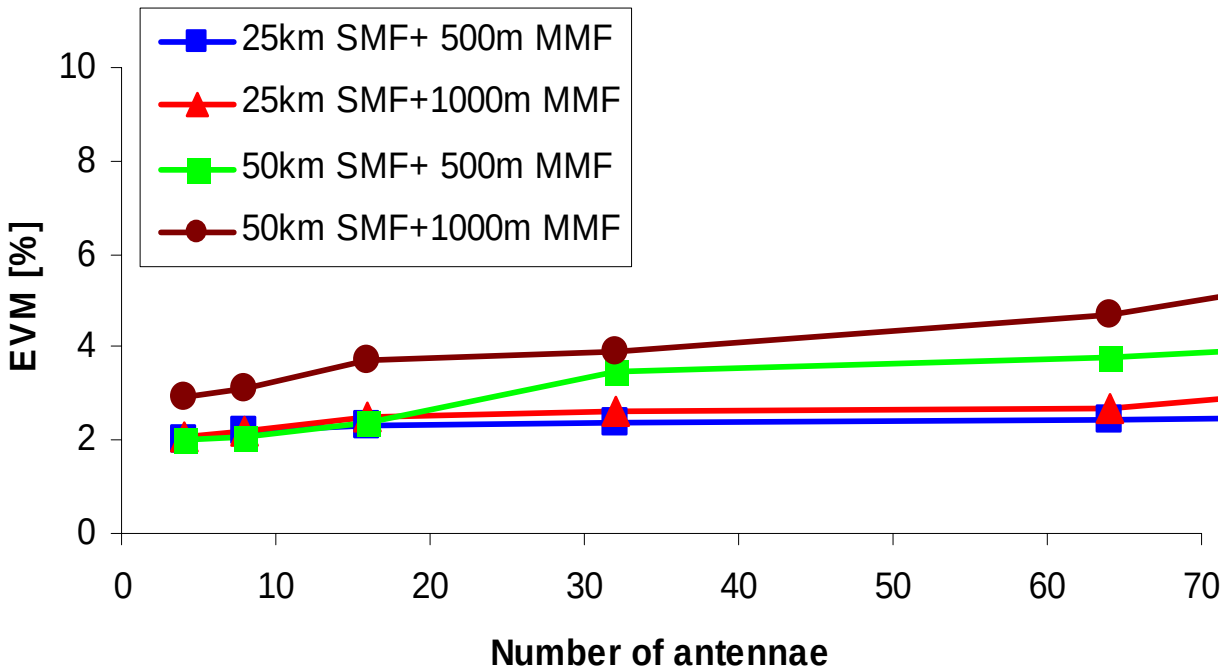

Optical amplifiers are used to maintain signal strength

How reconfigurable are RF over fibre networks?

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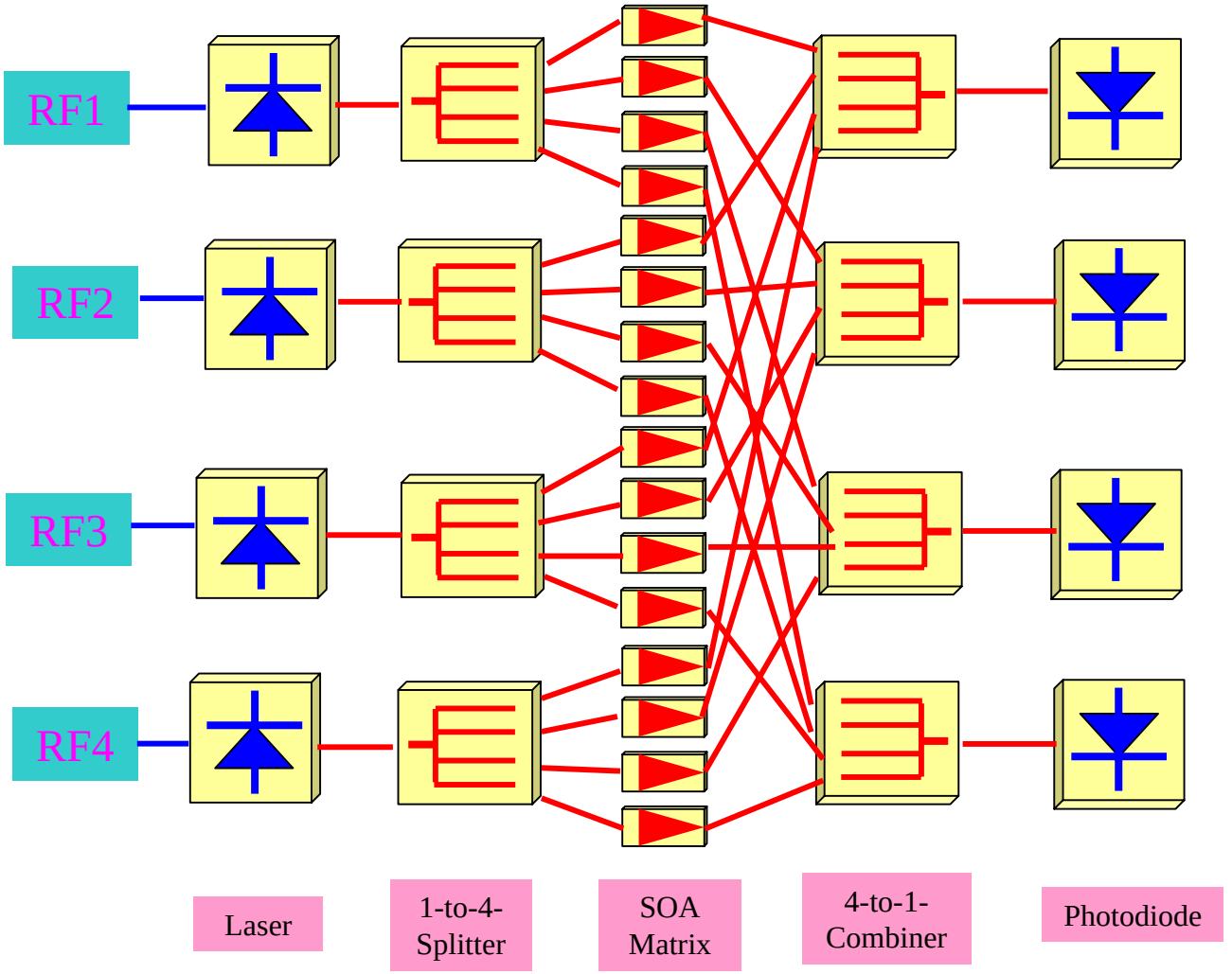
Optical amplifiers are used to route signals

Lossless routing is Possible

How fast can the reconfiguration operate at?



Applications: Reconfigurable RF over Fibre Networks

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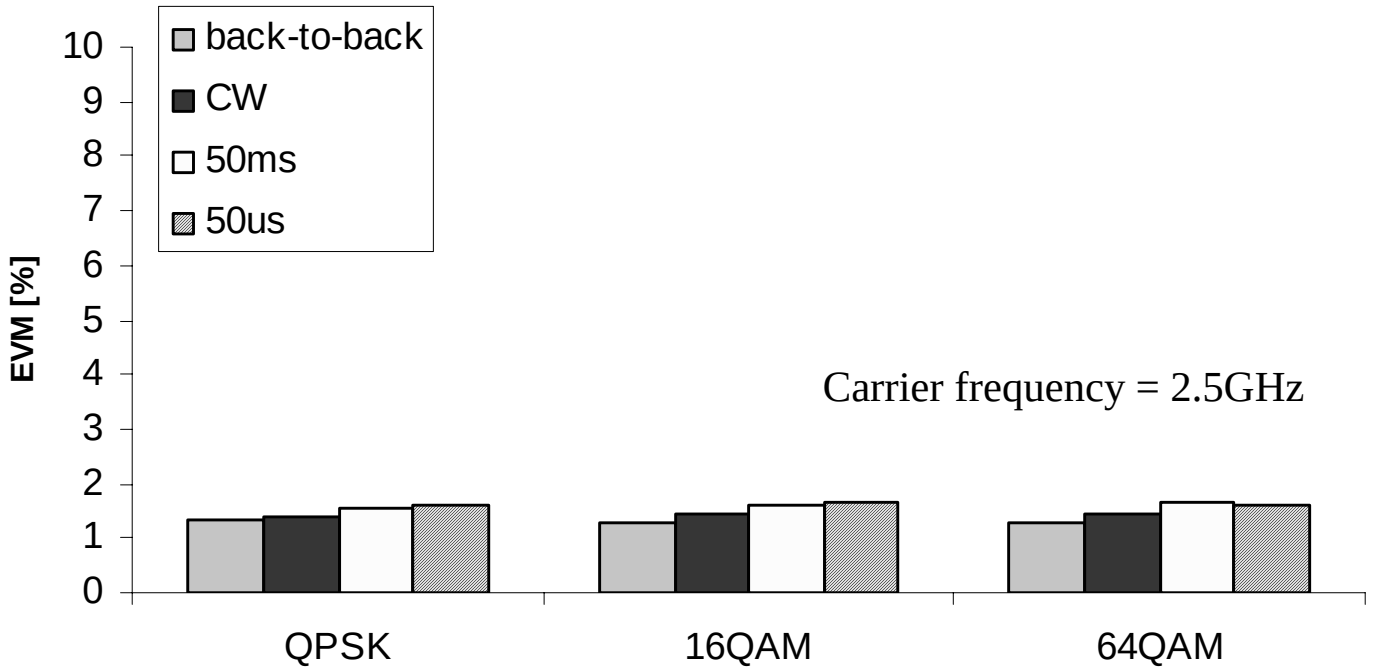
Switching time of 50 us limited by drive electronics



Signal Degradation < 0.5%

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For the future ...

- What are the implications of this?
  - Will the technology cause multiservice systems to be centralised or just extended?
  - What will the cost model be – integrator or user owned?
  - How should quality of service be defined in such systems?
  - How might customers use this technology?
    - Seemless switching between services?
    - Control of the RF channel in-building?
    - Will this cause faster uptake of new standards or slower?
    - Creation of distributed WLANs?