TIMING AND THE TELECOM INDUSTRY:

THE CHALLENGE OF FRAGMENTATION

KEY NOTE SPEECH

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AGENDA

- The past : trunking timing distribution
- The present : the packet layered timing distribution
- The future : 50 billions of user devices, some of them with synch requirements.

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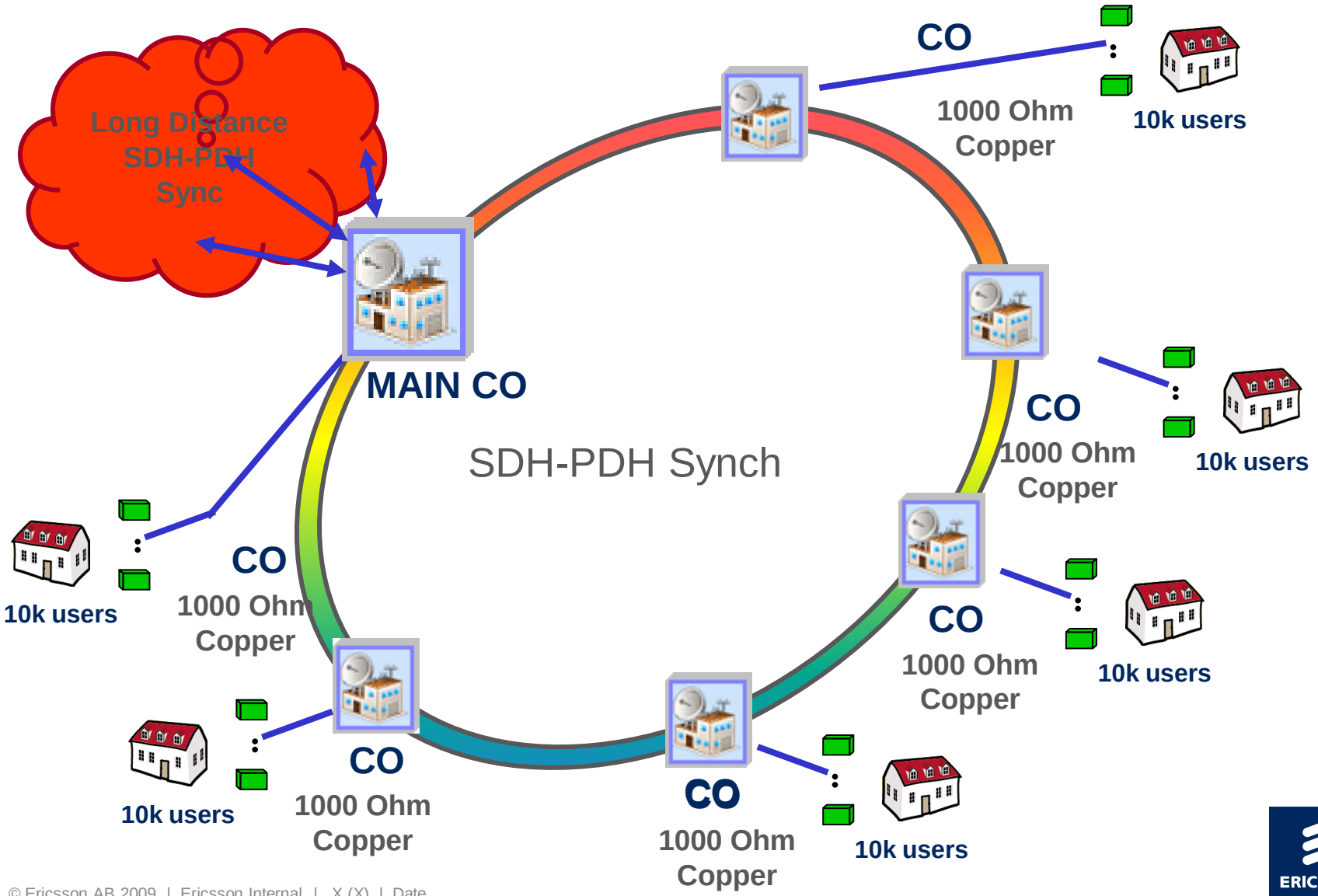
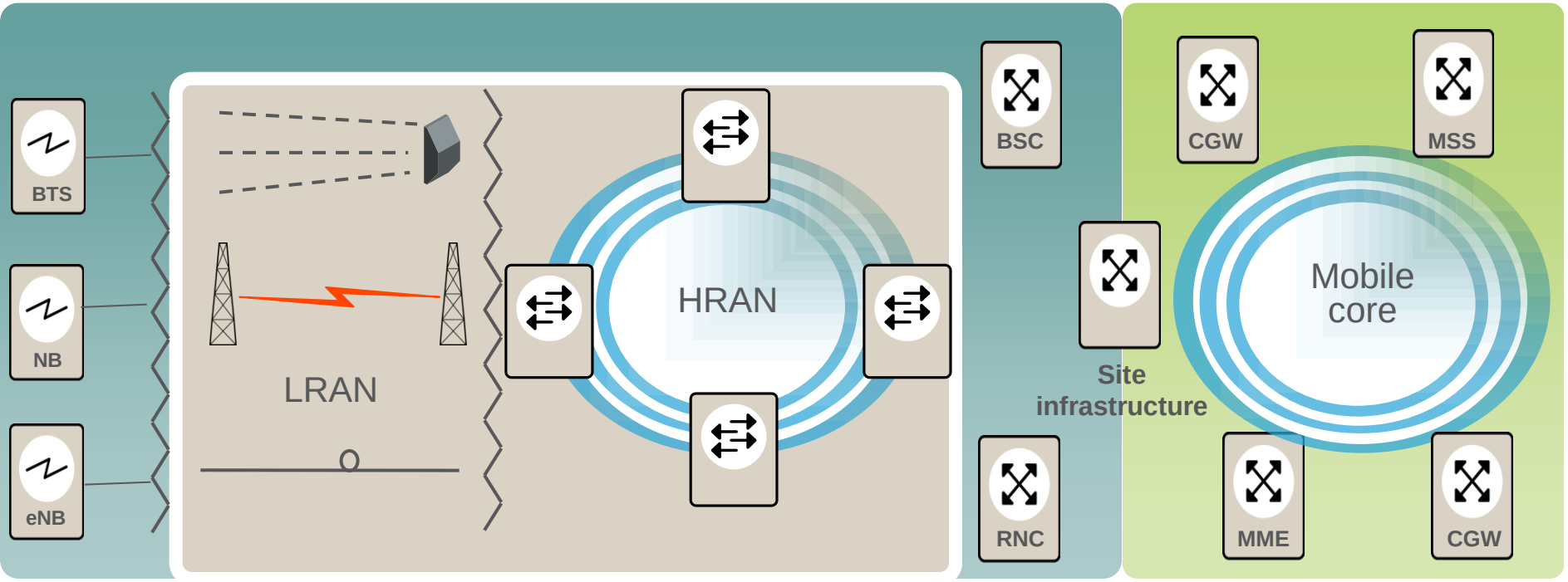
THE PAST: TIMING DISTRIBUTED VIA TRUNKING

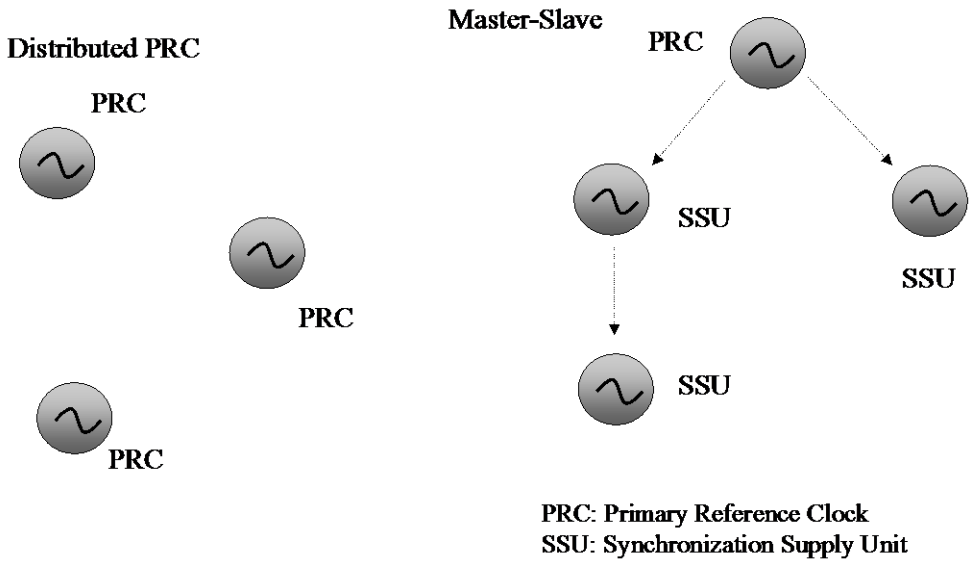


MOVING TOWARDS ALL-IP NETWORKS

› The Italian network, like the other ones, is moving towards an all-IP network that implies nesting and fragmentation towards the end users.

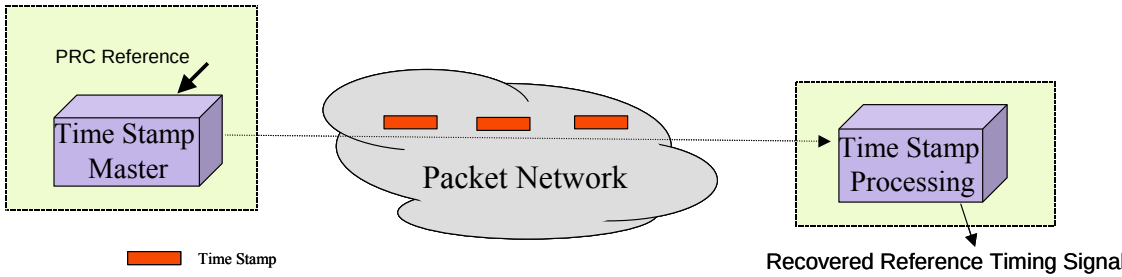


TIMING SIGNAL DISTRIBUTION OPTIONS

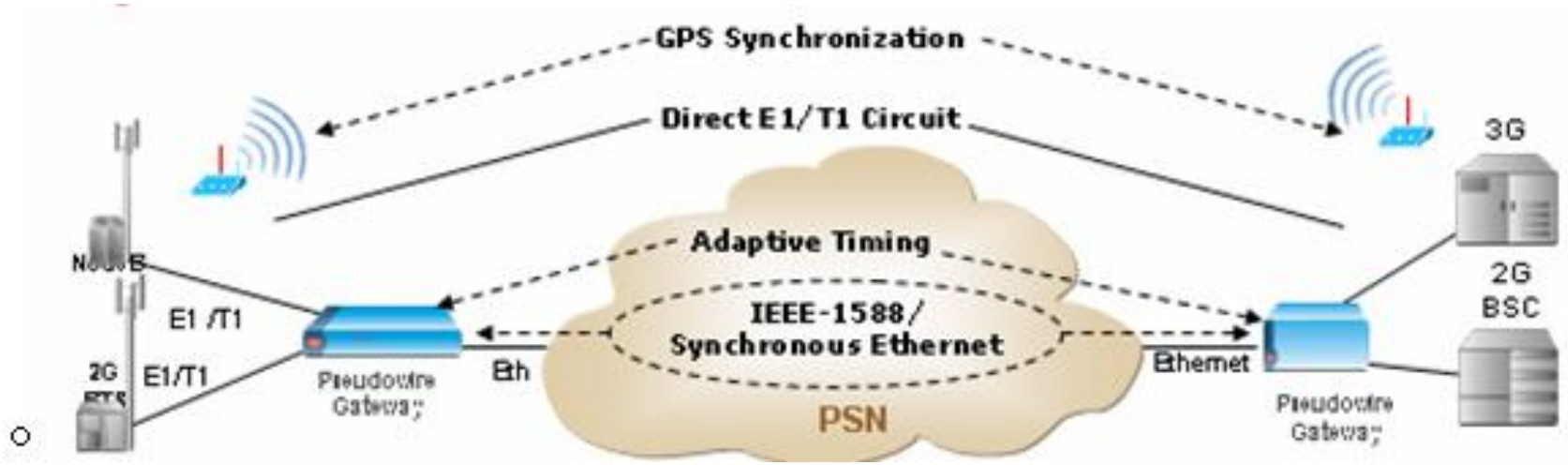


The “traditional” solutions:
Distributed PRCs (e.g. GPS)
or sync via synchronous
Physical layer (e.g. SDH)

The “new” solutions:
sync via dedicated
sync packets
(e.g. IEEE1588, NTP)



THE PRESENT: SYNCHRONIZATION OVER PACKET NETWORKS



- Direct connection of an E1 circuit from the BSC/RNC per cell site
- GPS synchronization system at the cell site and the BSC/RNC site
- Adaptive timing over packet with distribution at the BSC/RNC site and recovery at the cell site
- IEEE 1588 or Synchronous Ethernet in the access network

IUB REQUIREMENT ON IP TRANSPORT

- WCDMA Iub requirements
  - A certain level of quality is required for good system performance:
  - Delay at Iub[1]
    - Propagation delay priority traffic, maximum: 30 ms, target: 5ms
    - Delay variation priority traffic, maximum: 12 ms, target: 2ms
  - Packet Loss
    - Priority traffic Less than $1x10^{-6}$
  - Synch algorithm requirement
    - Additional requirements on PDV
- Requirements on HS Best Effort data only
  - No strict characteristics limitations. A delay of 50 ms, delay variation of 30 ms and a packet loss of $1x10^{-6}$ will roughly half the end-user throughput on Iub

[1] *For Iur traffic both Iub and Iur leg need to be considered*

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SYNCH ISSUES IN A FEMTO/PICOCELL ENVIRONMENT OVER IP (SOURCE IETF)

A femto/pico in CPE is connected to a core network via metro ethernet backhauling.

GPS within a femto/picocell: Cost, Satellite visibility, (which in residential/urban environments tends to decrease, a not tuned femto is interfering with other femto/picos and with the macro network).

Scalability: millions of devices are impacting the clock server throughput and their dimensioning.

NAT functionalities at Home GW: With respect to synchronization, this could limit the ability of a femto/picocell to communicate directly to a Clock server..

Security: it is mandatory to protect the pico/femto traffic onto the IP backbone, but the encryption of timing messages could introduce delays and CDV issues affecting the accuracy.

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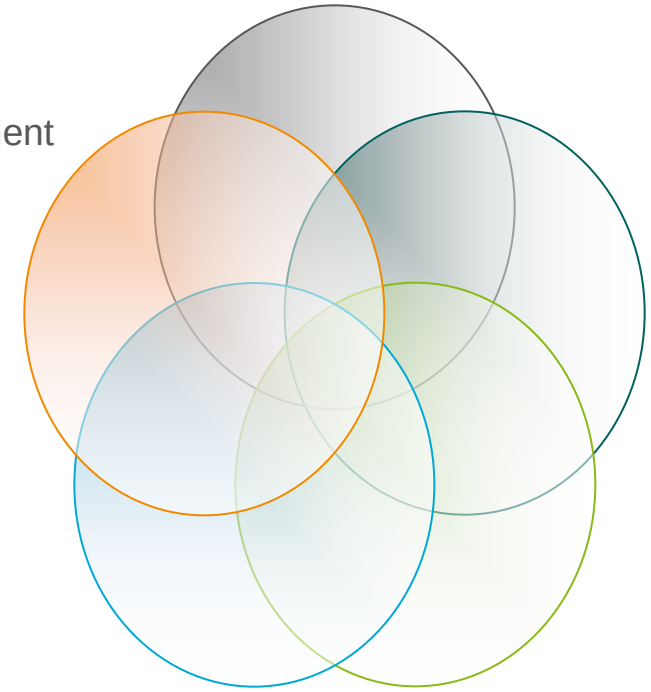
WHAT IS THE M2M MARKET? IMPACTS ON TIMIMG?

Utilities
e.g. Automatic Metering
Smart grid

Transport
e.g. eCall
Fleet management
Road charging
Smart insurance
Travel assistance
Alco lock
Goods tracking
Remote diagnostics

Property/Asset management
e.g. Security solutions
Machine supervision
Smart buildings



Retail
e.g. Point of Sale terminals

Healthcare
e.g. Remote diagnostics

Five industries with *mission critical* M2M communication end2end requirements

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M2M

- It promises to connect fleets of cars that are collecting their sensors outputs.
- It could performs maintenance of end users' home networks (synchronized as well).
- It could be used to drive healthcare devices and performs critical (for timing) operations.
- It could collect data from millions of wired and wireless sensors……

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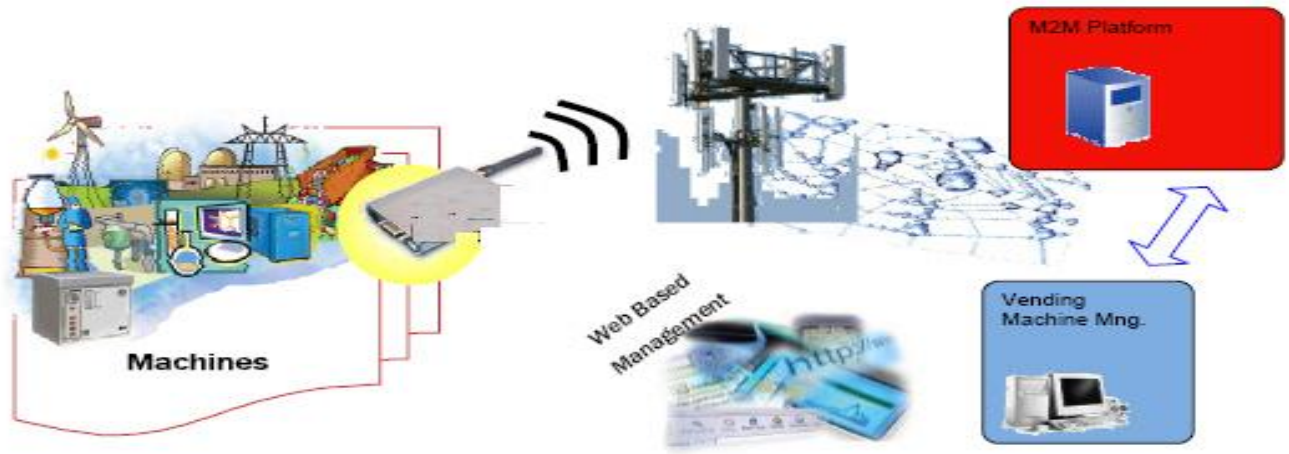
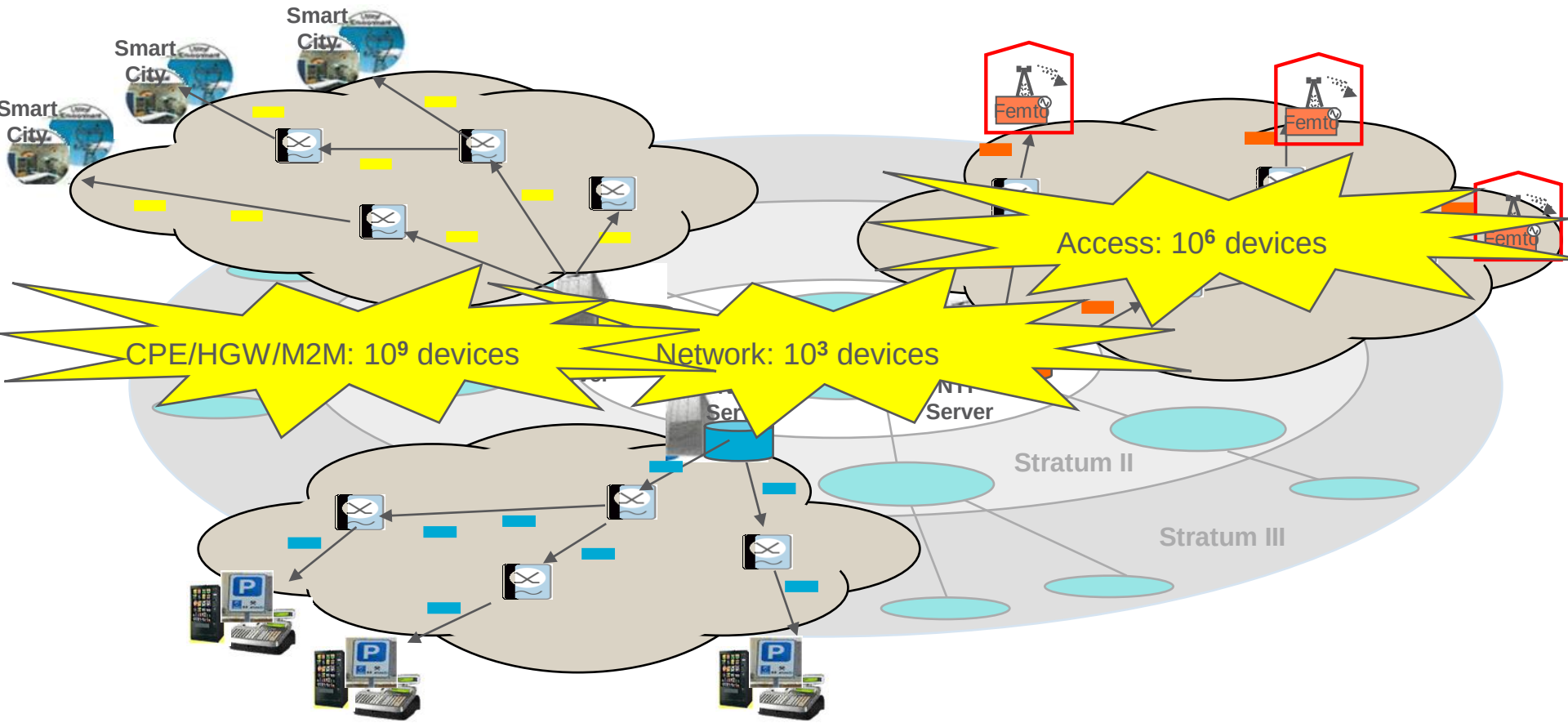
SYNCHRONIZATION FOR THE EVOLVING MOBILE NETWORK

- Femto/picocells and M2M applications carry the mobile technology more deeply into the customer network.
- Just like a typical macrocell, they require a certain level of synchronization (frequency or phase/time) on the air interface, predominantly frequency requirements.
- Extension of mobile technology to millions of devices introduces peculiarly challenges from point of view of synchronization



SYNCH STAR STOVEPIPES



50 Billions Devices in the network ?

CONCLUSIONS

- The synch distribution moved from a trunk architecture to a full IP access architecture. (thousands of nodes)
- Also Mobile has moved and requires a synch over IP dedicated capability (hundred thousands of nodes)
- Now the user synchronized devices are becoming at CPE level (millions of nodes).
- The future is towards M2M that is adding another order of magnitude.

- Are the present solutions (GNSS, NTP/PTP) able to cope this growth?

THIS IS THE CHALLENGE

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