

# Sync Challenges In Telecom Networks

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**TDM**



**Ethernet**

**Carrier Ethernet,  
Mobile Backhaul**

**Frequency  
Only**



**Frequency +  
Time**

**WiMAX, TD-SCDMA,  
TD-LTE, LTE-MBMS,...**

**GPS**



**GNSS**

**Galileo, Beidou,  
GLONASS,...**

**Infrastructure**



**Premise**

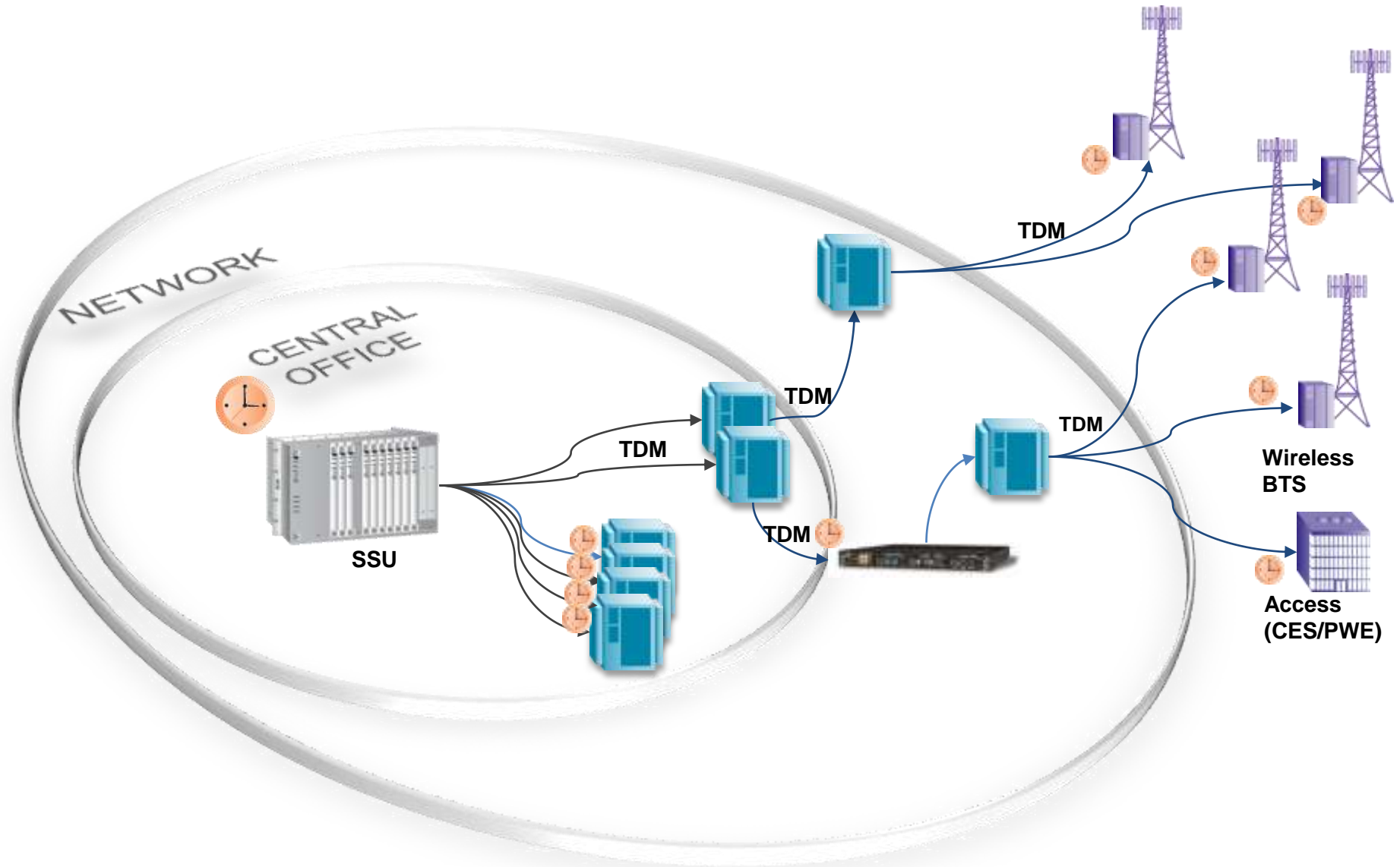
**Femtocells**

TDM



Ethernet

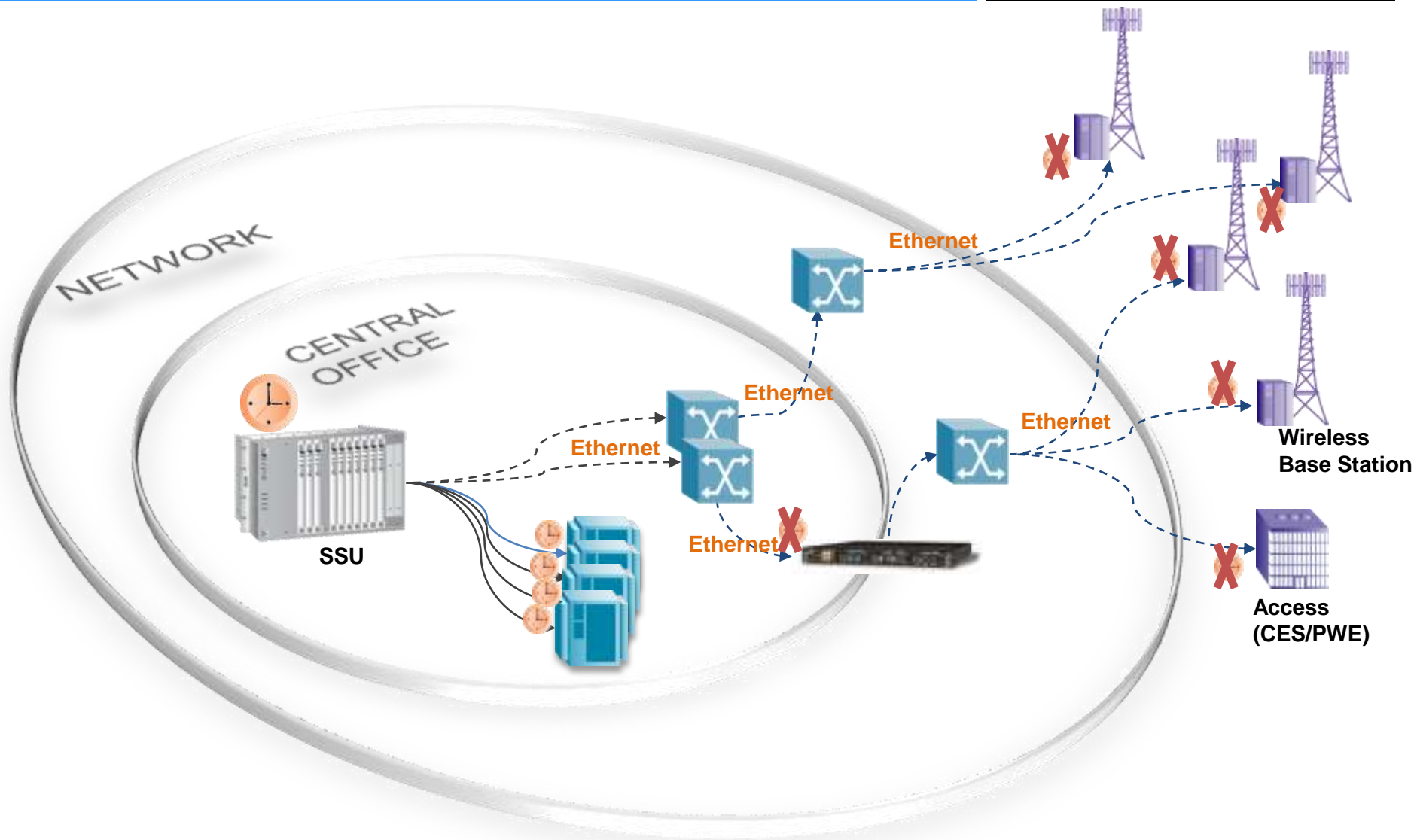
Symmetricon



TDM



Ethernet



TDM

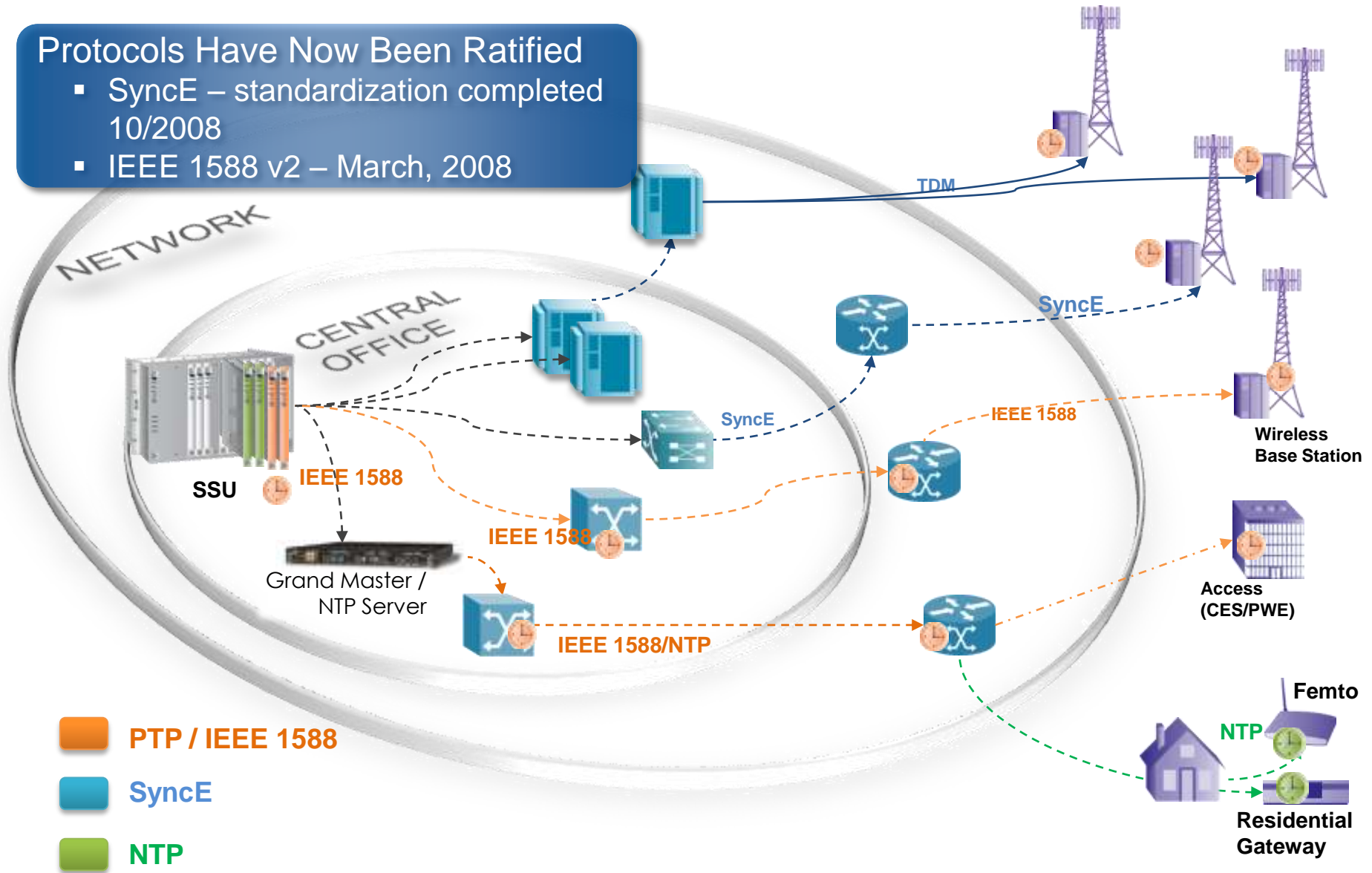


Ethernet



### Protocols Have Now Been Ratified

- SyncE – standardization completed 10/2008
- IEEE 1588 v2 – March, 2008



PTP / IEEE 1588

SyncE

NTP

Frequency Only



Frequency + Time



Application	Frequency	Time
CDMA2000 (includes femto)	50 ppb	<3 $\mu$ s when locked to GPS
GSM/		
UMTS		
UMTS		
TD-SC		nce
WiMA (inclu		
LTE (F		
LTE (T		ference
LTE MIMO	50 ppb	500 ns inter-cell phase difference
LTE MIMO	50 ppb	500 ns (0.5 $\mu$ s) inter-cell phase difference

**> Holdover, practical requirement:**

- Customer Experience
- Revenue Protection
- Regulatory – E911

**> High End Oscillator (Rb) needed**

**> Multiple Technologies Aiding One Another**

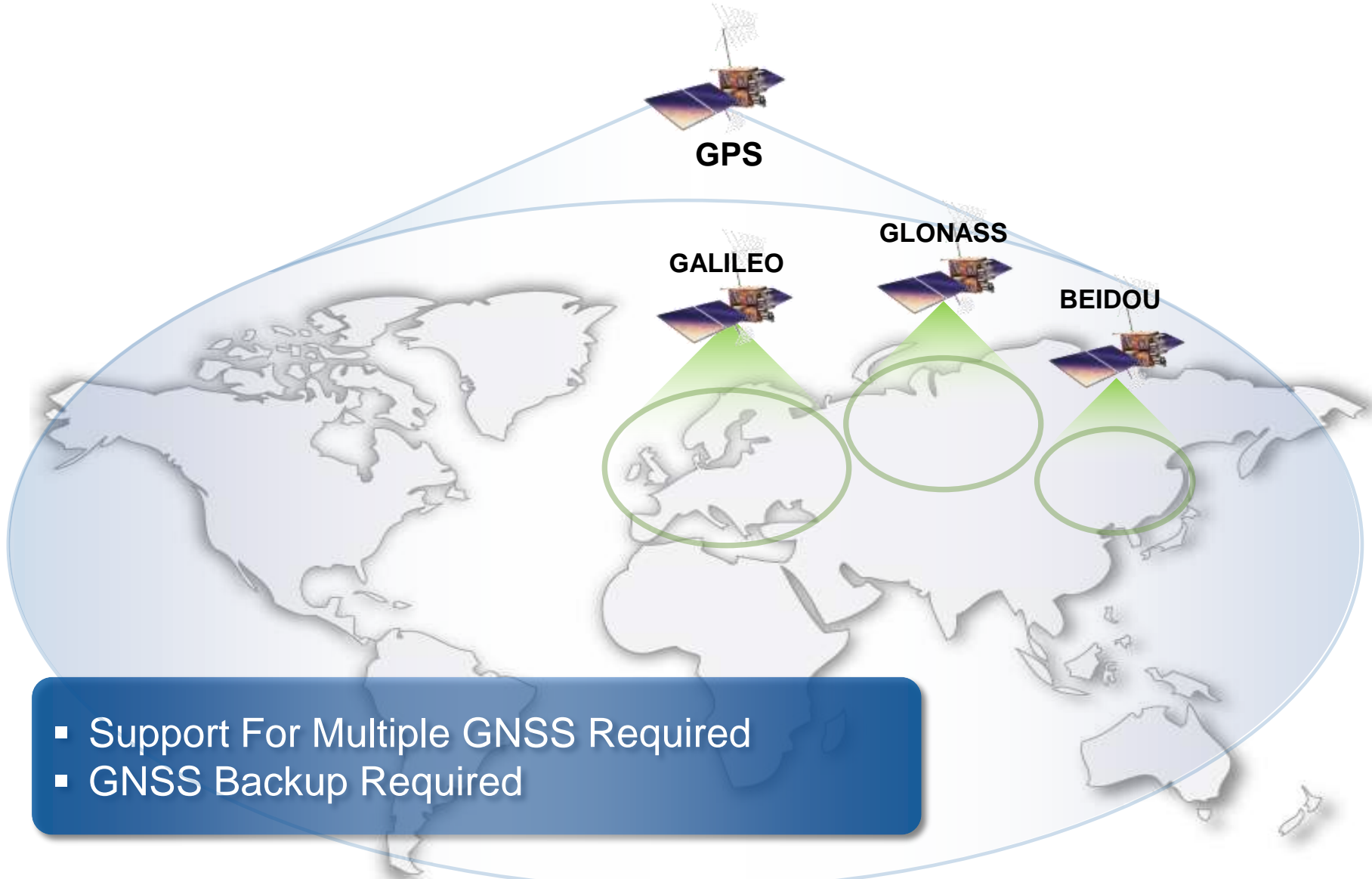


GPS



GNSS

Symmetricon



GPS

GALILEO

GLONASS

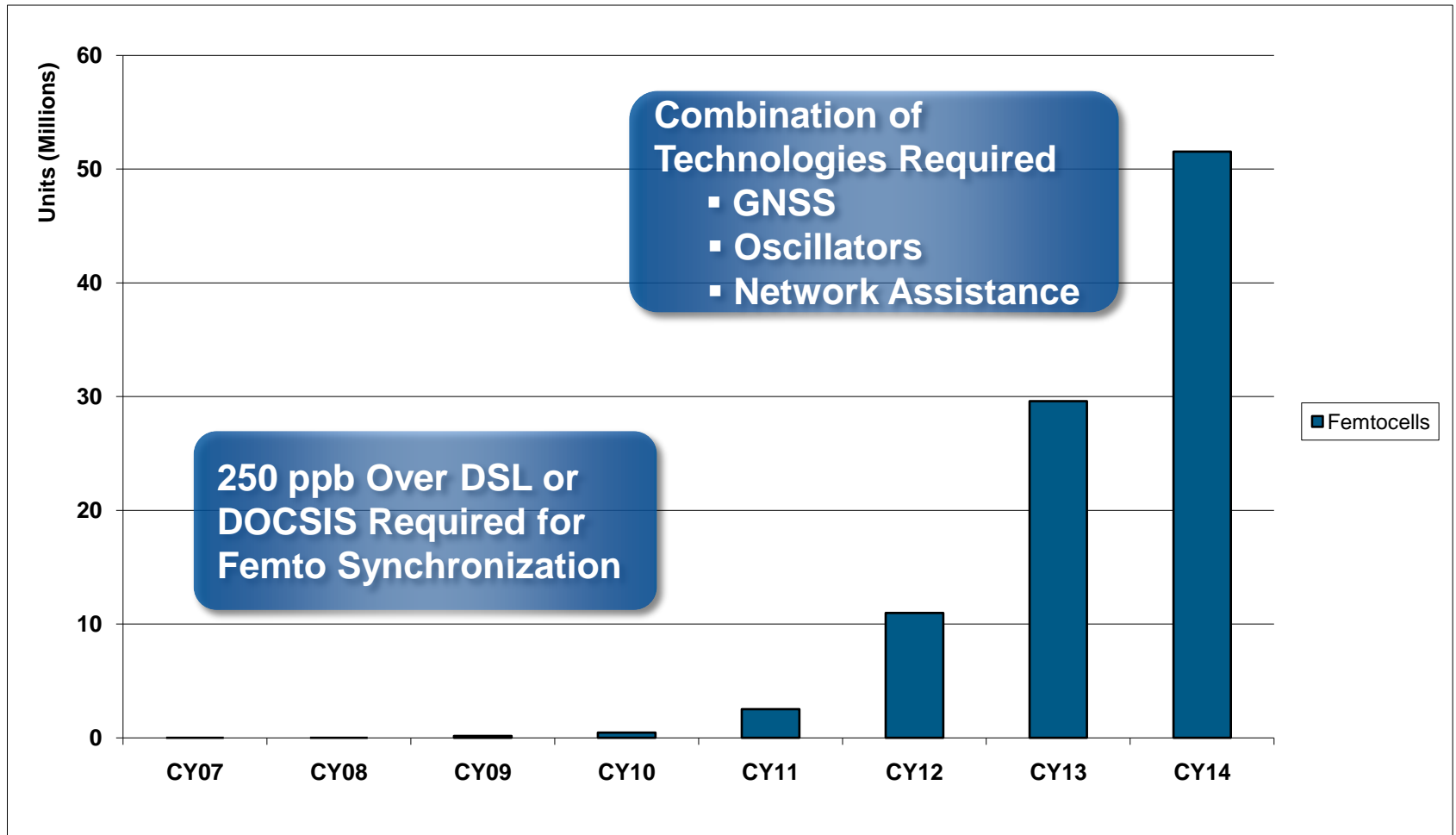
BEIDOU

- Support For Multiple GNSS Required
- GNSS Backup Required

Infrastructure



Premise



Source: Infonetics, March 2010



Multiple technologies required to aid one another

Holdover is a critical requirement



**GNSS with PTP Assist**



**GNSS with Rubidium Holdover**



**PTP with Rubidium Holdover**

**GNSS, PTP, Rubidium – You Need 2 Out of 3**

# It Takes Two, Baby (Marvin Gaye)



**One can have a dream, baby  
Two can make that dream so real  
One can talk about bein' in love  
Two can say how it really feels  
One can wish upon a star  
Two can make that wish come true, yeah  
One can stand alone in the dark  
Two can make the light shine through  
It takes two, baby  
It takes two, baby  
Me and you, just takes two  
It takes two, baby  
It takes two, baby  
To make a dream come true, just takes two**



**Thank You!!!**

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