

## Measuring The Performance Of 3G Networks



**inCode**<sup>®</sup>

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# inCode Overview

## inCode Overview



- Founded in 1998
- Headquartered in San Diego, California
- Offices in Atlanta, Paris, Brussels, Guatemala, Calgary etc.
- Backed by Sequoia Capital, inOvate and Focus Ventures

## People

- Over 400 experienced professionals with average experience of 8 to 10 years
- Diverse mix of business savvy and technology expertise
- Leading financial analysts and business consultants; engineers and technologists, program managers and integration specialists
- Diversity of nationalities, international experience and languages
- Our people are our greatest assets, we are passionate about wireless and love what we do

## Sample Clients



## Wireless Technology Lab – One Step Ahead



- “Smallest 3G wireless carrier in the world”
- Advisory council from leading US and International wireless carriers
- Provide independent testing, integration and interoperability of next generation technologies and applications
- GPRS, UTMS, Push-To-Talk, SMS, MMS, LBS, 1xRTT, 1xEVDO, 802.11, OSS/BSS
- IMS Lab setup by September 2005

# inCode Overview

## Wireless Technology Life Cycle

Market Analysis and Business Strategy

Technology Strategy

Technology Architecture

Technology Integration

Technology Deployment

Network Engineering

Network Deployment

System Management

## Carriers and Equipment Providers



### Strategy and Technology Services

- G-path Migration Strategy
- Wireline & Cable MSO Strategy
- MVNO/E Strategy
- IMS Strategy and Architecture
- Network Cost Modeling
- E911 / LBS Strategy
- Business Start-up Strategy
- Content/Media Strategy
- Wireless Broadband Strategy



### Integration Services

- PTT Integration & Testing
- Data Application Integration (SMS, IM, MMS, IP VM)
- LBS integration
- Device Testing
- Core Network Integration
- WNP
- Wireless Data Performance
- Revenue Assurance



### Engineering Services

- RF Engineering & Optimization
- Transport Network Design and Optimization
- Switch Engineering & Optimization
- Project Management Office
- E911 Deployment

## Enterprise

- Network Evolution
- Converged Network Services
- Mobility/Wireless Design Advisory Services
- Public / Private Infrastructure
- Cost Management
- Wireless Network Security

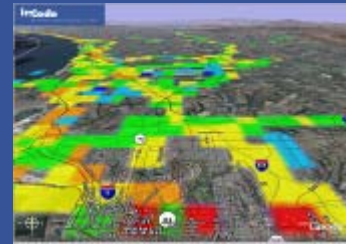
Integration and Management for Industry Targeted Solutions:

- Mobile Office
- Mobile Resource Management
- Transportation/Telematics
- Asset Management
- Inventory/Supply Chain

- Wi-Fi Deployment (Design to Testing)
- Distributed Access Systems
- VOIP
- Municipal Networks
- Land Mobile Radio

## Products

### Wireless Barometer™ SQM Tool



### inCode Wireless Solutions



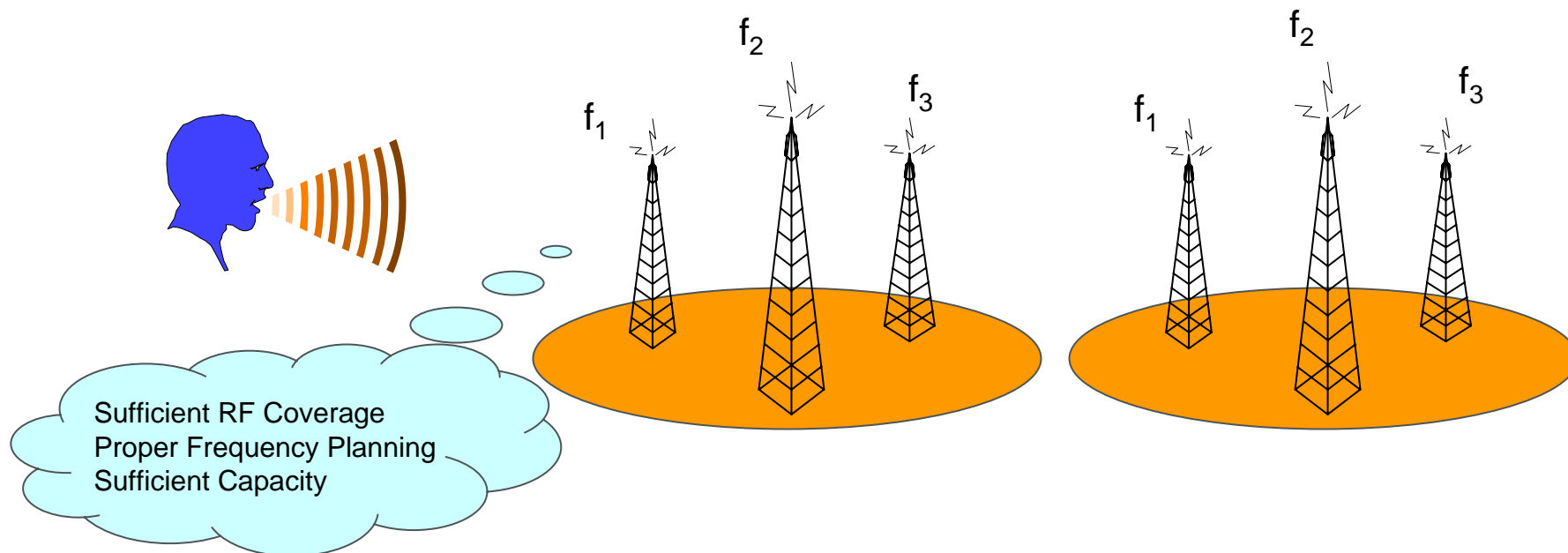
### Engineering Tools

WirelessPro, StatCorr, MADAR



# Challenges Of Measuring 3G Network Performance

- The primary application on 2G networks was voice



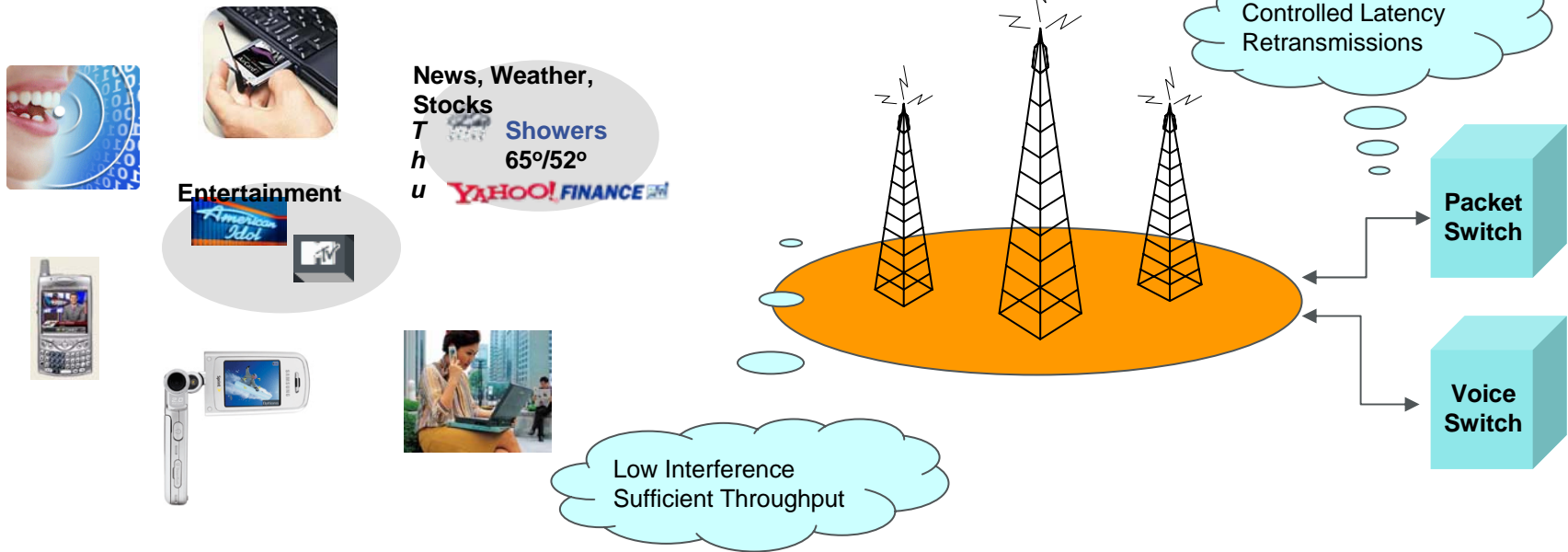
- Voice performance on circuit switched networks is measured through Key Performance Indicators (KPIs) such as:

- Quality – Subjective Measure or Mean Opinion Score (MOS)
- Network Accessibility – Call Setup Success Rate
- Network Retention – Dropped Call Rate

Radio Access Network Dominants Performance On 2G Networks

# Challenges Of Measuring 3G Network Performance

- 3G networks support a variety of applications that each require different KPIs and KPI thresholds

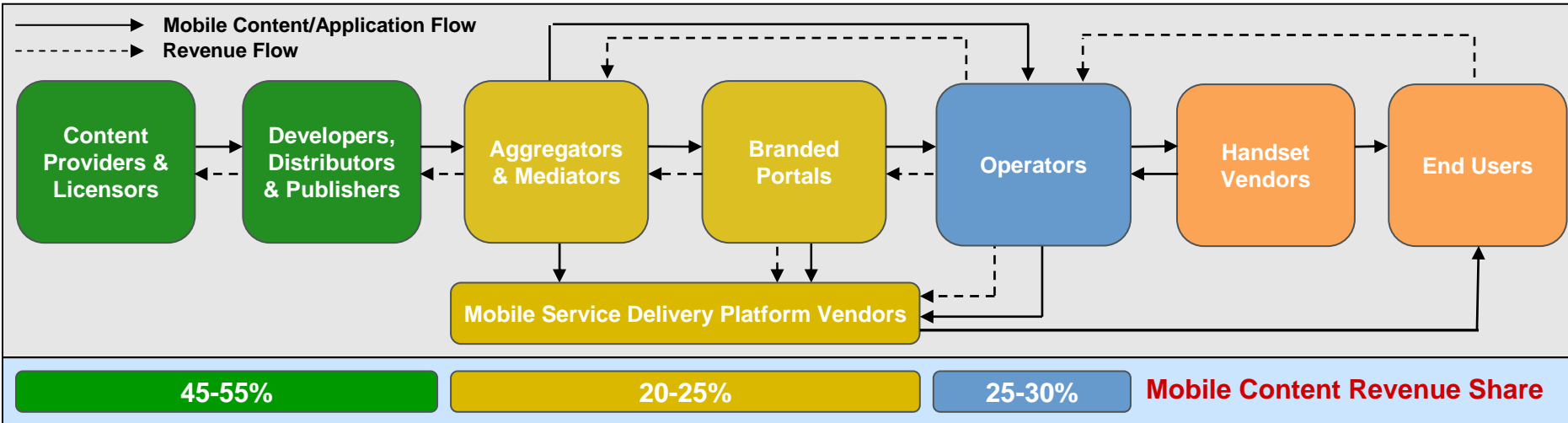


- 3G applications have sensitivities across latency, offered data rate, retransmission rates and other data centric measures
- KPIs such as call setup rates, dropped call rates and error rate do not reveal the total quality picture or the user perspective

Mobile Content On 3G Networks Evolve Well Beyond Voice

# Challenges Of Measuring 3G Network Performance

## Mobile Content Value Chain



## Value Chain – Key Players

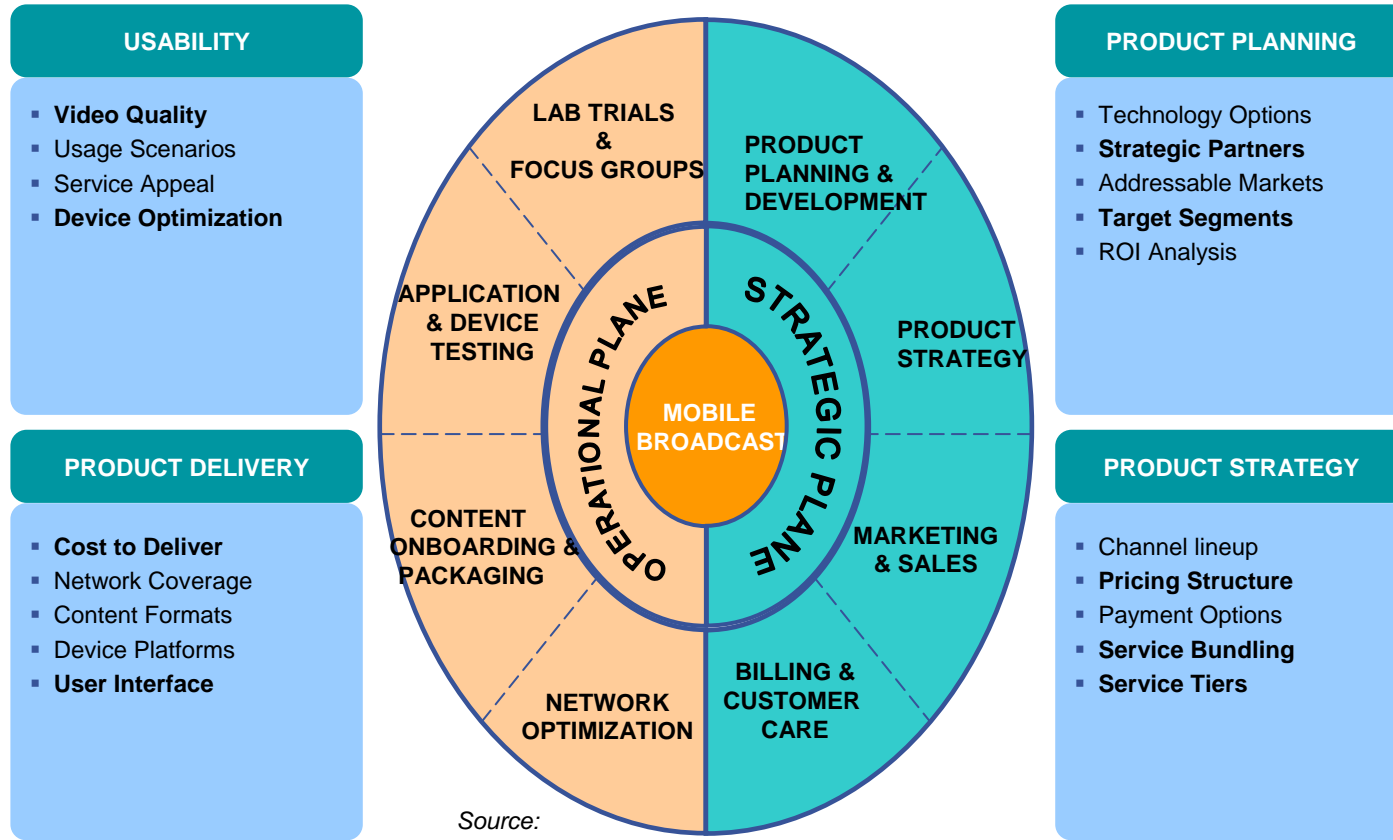


❖ Increasing number of Content Providers, Publishers and Aggregators are going Direct to Consumer

- ✓ Driving the growth in off-deck portals
- ✓ Leading to different content discovery strategies

# Challenges of Measuring 3G Network Performance

## 3G Application Example – Mobile TV

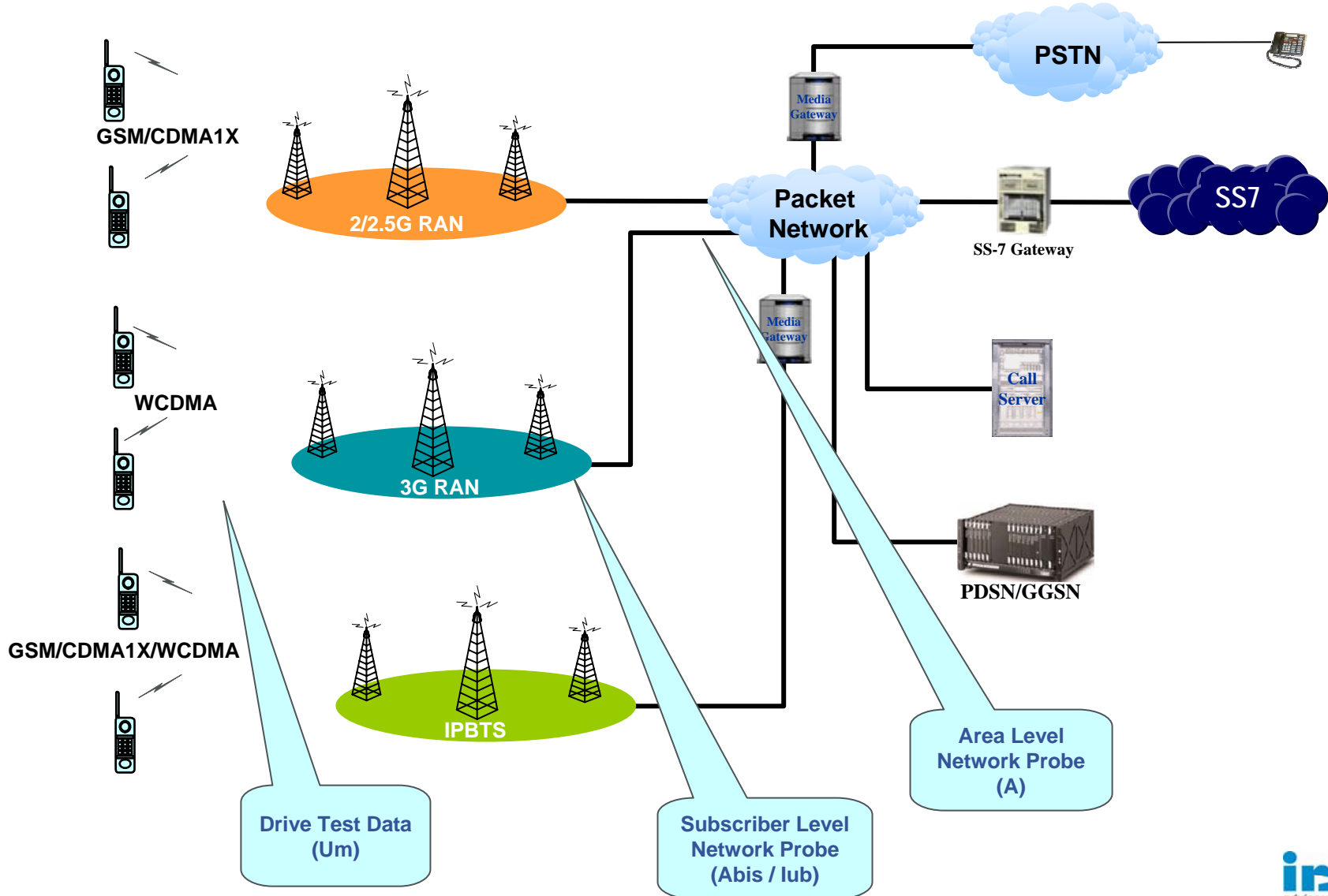


Service pricing, end user experience, and a cost-effective delivery platform are key success factors (KSFs) for Mobile TV services

# Challenges of Measuring 3G Network Performance

## Data Extraction

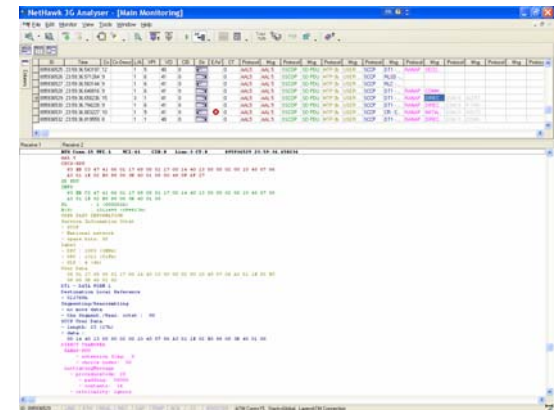
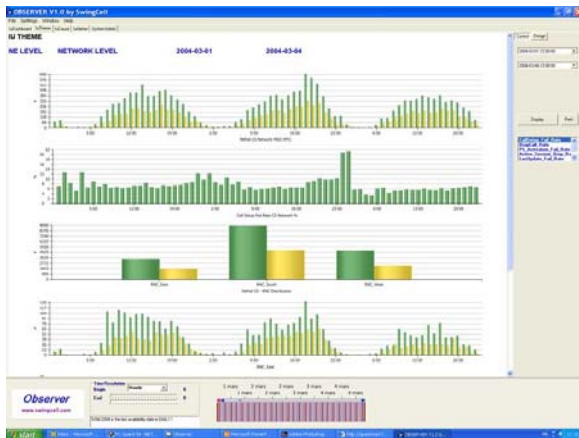
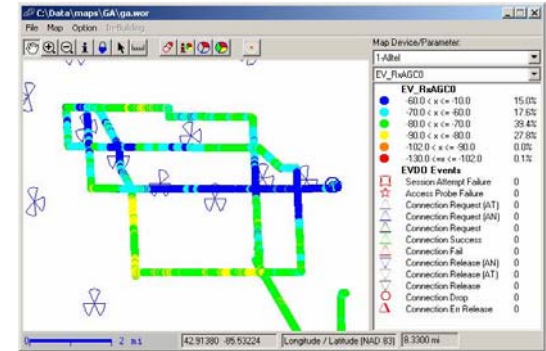
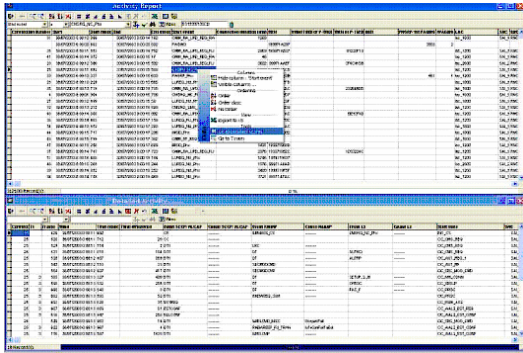
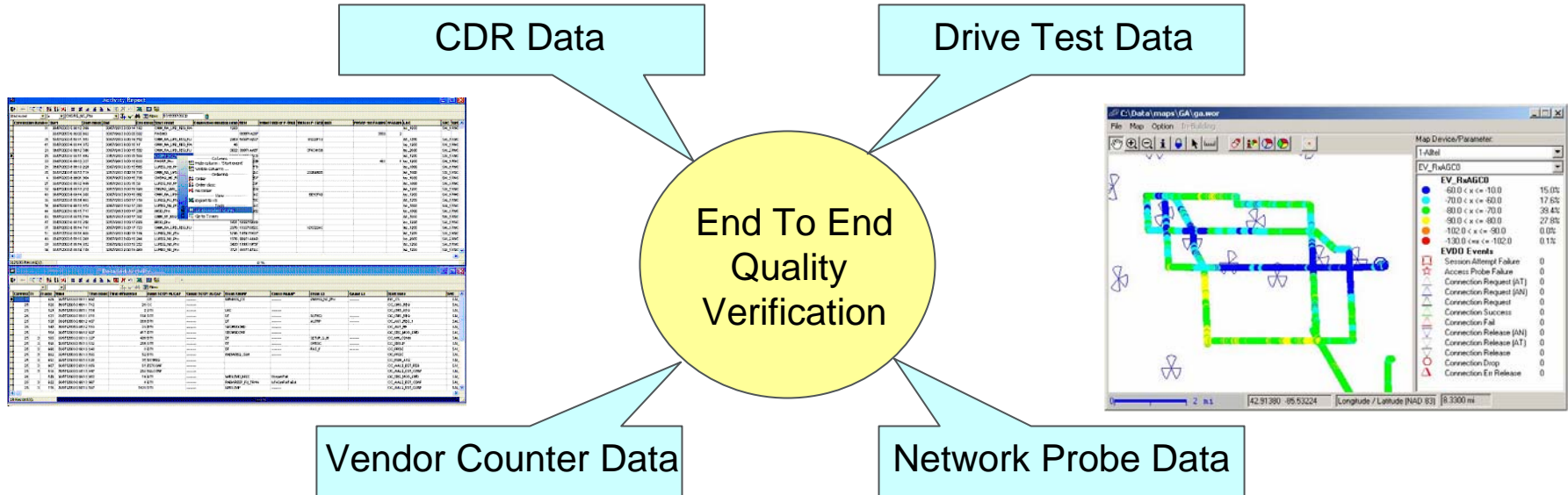
Gather data on network performance from various locations throughout the transport chain



# Challenges of Measuring 3G Network Performance

## Data Analysis

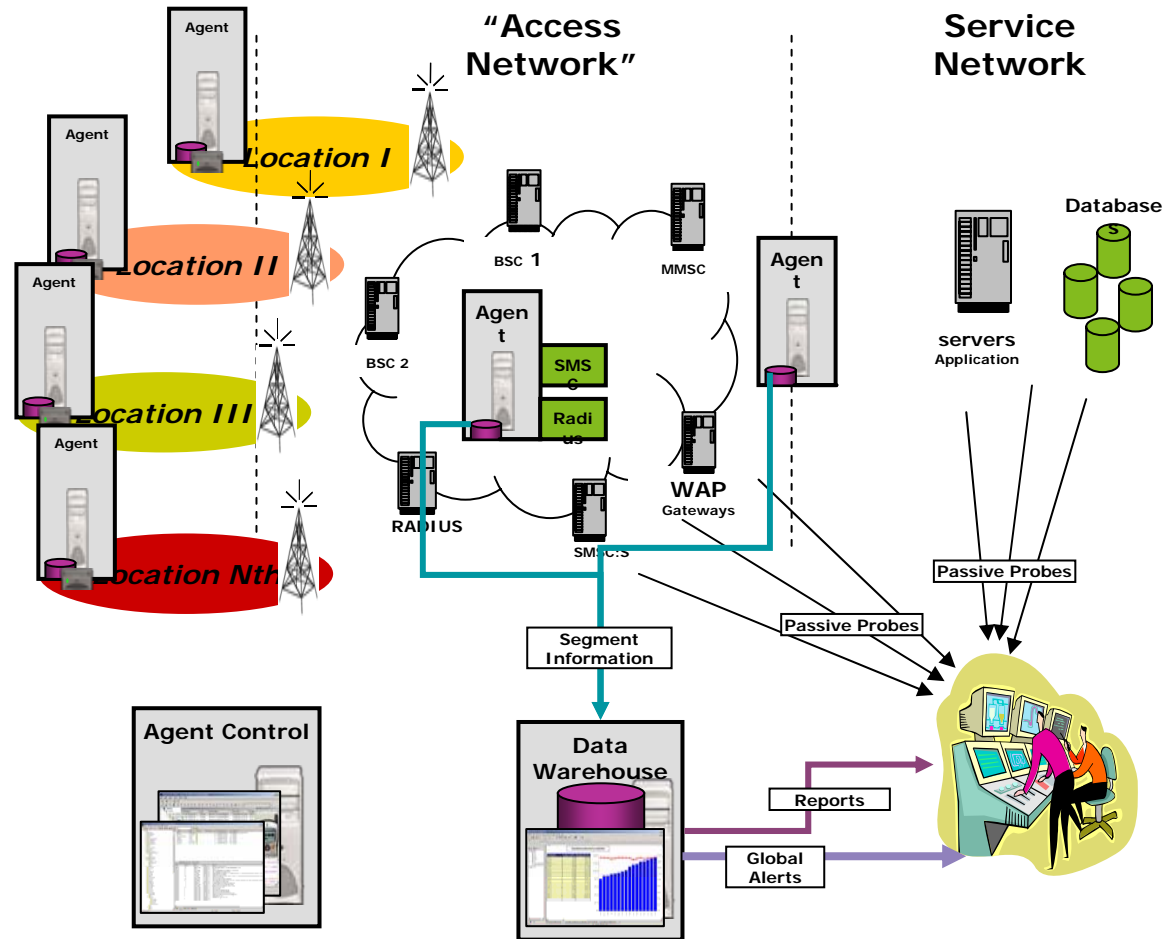
Analyze data sets to extract trends



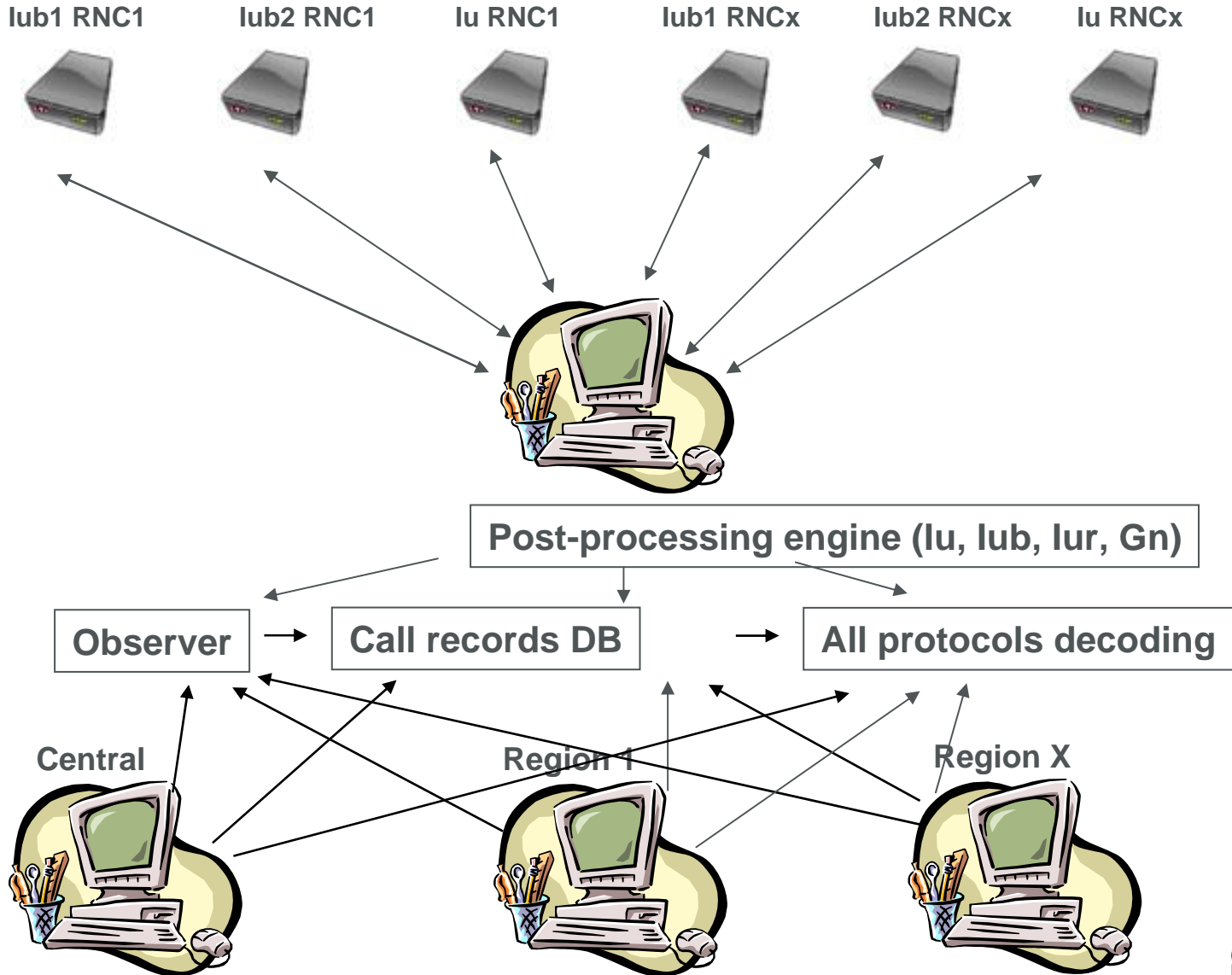
# End To End Network Performance Monitoring

Challenge with analyzing data sets into meaningful measures of performance to establish KPIs at various levels

- Network KPIs
- KPIs per applications
- KPIs per device

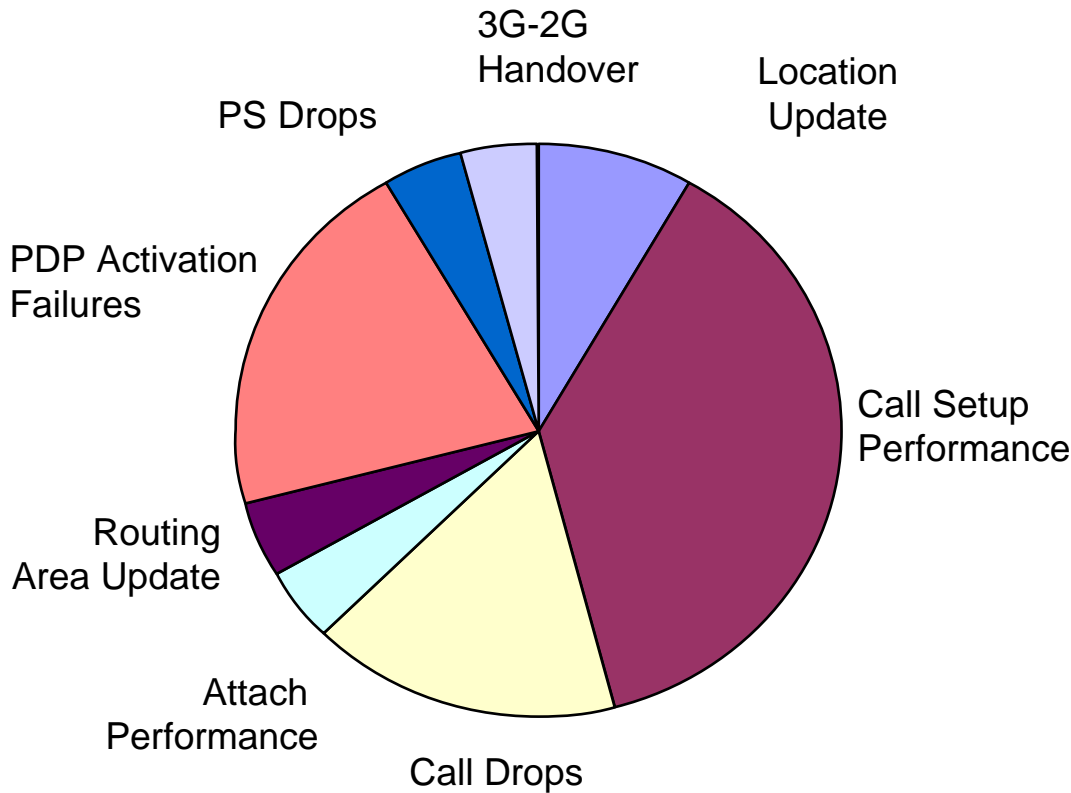


# End To End Network Performance Monitoring



# End To End Network Performance Monitoring

## KPIs Per Problem Type



### Call Setup Performance Breakdown

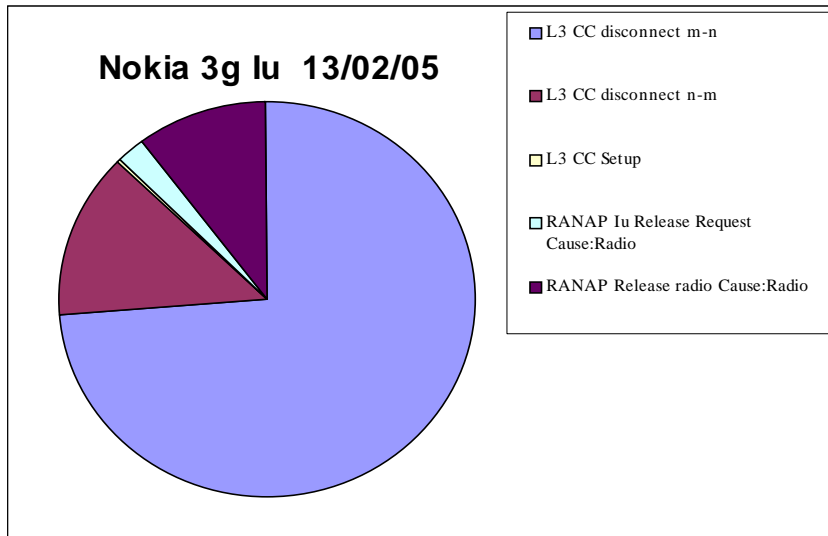
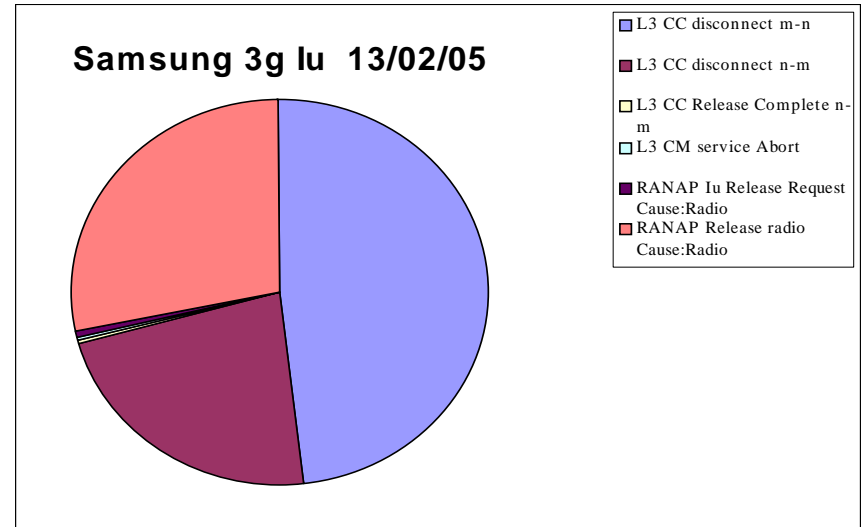
- No Circuit Channel Available
- Switch equipment congestion
- Resource Unavailable, unspecified
- No Resource Available
- Invalid RaB parameters configuration
- No paging response
- Wrong release cause "Normal unspecified"
- Radio connection with UE lost" or "Release due to UTRAN" *Priority1*
- 3G-2G Relocation procedure failure



# End To End Network Performance Monitoring

## Performance Per IMEI / UE Type

- Performance monitoring down to the UE / device level indicates which devices support applications optimally
- Assists in categorizing devices that offer premium service or poor service across various applications



### MOC

	Moc_Attempts	Moc_Failures	Pc
All Mobiles	16844	550	3.27%

Mobile type	MocAttempts	Moc_Failures	Pc
Test+ others	3048	153	5.02%
Motorola	3985	137	3.44%
Nokia	72	6	8.33%
Samsung	6346	163	2.57%
Sharp	542	23	4.24%
Siemens	16	0	0.00%
Sony Ericsson	2835	68	2.40%

### MTC

	Mtc_Attempts	Mtc_failures	Pc
All Mobiles	24905	583	2.34%

Mobile type	Mtc_Attempts	Mtc_failures	Pc
Test+ others	4562	241	5.28%
Motorola	5396	161	2.98%
Nokia	62	0	0.00%
Option	112	0	0.00%
Samsung	10058	118	1.17%
Sharp	1048	11	1.05%
Sony Ericsson	3667	52	1.42%

# Tools

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Some possible tools:

Actix - <http://www.actix.com/>

SwingCell - <http://www.swingcell.com/>

Ixia - <http://www.ixiacom.com>

NetIQ - <http://www.netiq.com>

ClearSight Networks - <http://www.clearsightnet.com>

QuadTex - <http://www.quadtexsys.com>

Shenick diversifEYE - <http://www.shenick.com>

Candela Technologies - <http://www.candelatech.com>

Coordinated Systems Inc. (CSI) - <http://www.coorsysinc.com>

Netcordia - <http://www.netcordia.com>

NLANR - <http://dast.nlanr.net>

ArgoGroup - <http://www.argogroup.com/>

# Conclusion

- Measuring performance on 3G networks presents a challenge due to the diversity of applications offered
- Low interference networks is critical in supporting most data centric applications
- Tools capable of analyzing data sets from various points in the transport network are critical to tracking performance
- Developing KPIs beyond the system level yield more insight on user perception
- Closely monitoring changes in traffic usage is important

